DigiTrak® Eclipse®

SST® Guidance System

Operator's Manual

DCI® Digital Control Incorporated

DCI Headquarters
19625 62nd Ave. S., Suite B-103
Kent, Washington 98032 USA
Tel 425 251 0559 / 800 288 3610 *Fax* 253 395 2800
E-mail DCI@digital-control.com www.digitrak.com

DCI Europe
Kurmainzer Strasse 56
D-97836 Bischbrunn
Germany
Tel +49(0) 9394 990 990
Fax +49(0) 9394 990 999
DCI.Europe@digital-control.com

DCI India
SCO # 259, Sector 44-C
Chandigarh (UT) 160 047
Punjab, India
Tel +91(0) 172 464 0444
Fax +91(0) 172 464 0999
DCI.India@digital-control.com

DCI China
No. 41, Lane 500, Xingle Road
Minhang District
Shanghai P.R.C. 201107
Tel +86(0) 21 6432 5186
Fax +86(0) 21 6432 5187
DCI.China@digital-control.com

DCI Australia
2/9 Frinton Street
Southport, Queensland 4215
Australia
Tel +61(0) 7 5531 4283
Fax +61(0) 7 5531 2617
DCI.Australia@digital-control.com

DCI Russia
420059 Pavlyukhina Street
104, Kazan
Russia
Tel +7 843 277 52 22
Fax +7 843 277 52 07
DCI.Russia@digital-control.com

3-1200-00-D1

© 2003-2008 by Digital Control Incorporated. All rights reserved. February 2008 edition.

Trademarks

The DCI logo, CableLink®, DataLog®, DigiTrak®, Eclipse®, iGPS®, Intuitive®, *look-ahead*®, SST®, *target-in-the-box*®, *Target Steering*®, and TensiTrak® are U.S. registered trademarks, and DucTrak™, *FasTrak*™, *LT*™, SuperCell™, and TeleLock™ are trademarks of Digital Control Incorporated.

Patents

The DigiTrak® Eclipse® Locating System is covered by one or more of the following U.S. Patents: 5,337,002; 5,633,589; 5,698,981; 5,757,190; 5,764,062; 5,767,678; 5,878,824; 5,914,602; 5,926,025; 5,933,008; 5,990,682; 5,990,683; 6,002,258; 6,005,532; 6,008,651; 6,014,026; 6,035,951; 6,047,783; 6,057,687; 6,079,506; 6,095,260; 6,160,401; 6,232,780; 6,250,402; 6,396,275; 6,417,666; 6,454,023; 6,457,537; 6,496,008; 6,525,538; 6,559,646; 6,653,837; 6,677,768; 6,693,429; 6,727,704; 6,756,783; 6,756,784; 6,768,307; 6,856,135; 6,917,202; 6,954,073; 6,975,119; 7,015,697; 7,049,820; 7,061,244. Sale of a DigiTrak® Eclipse® Receiver does not convey a license under any patents covering the DigiTrak® Eclipse® Transmitter or underground drill housing. Other patents pending.

Limited Warranty

All products manufactured and sold by Digital Control Incorporated (DCI) are subject to the terms of a Limited Warranty. A copy of the Limited Warranty is included with this manual along with your DigiTrak® Eclipse® SST® Guidance System; it can also be obtained by contacting DCI Customer Service, 800-288-3610 or 425-251-0559, or by connecting to DCI's web site, www.digitrak.com.

Important Notice

All statements, technical information, and recommendations related to the products of DCI are based on information believed to be reliable, but the accuracy or completeness thereof is not warranted. Before utilizing any DCI product, the user should determine the suitability of the product for its intended use. All statements herein refer to DCI products as delivered by DCI and do not apply to any user customizations not authorized by DCI nor to any third-party products. Nothing herein shall constitute any warranty by DCI nor will anything herein be deemed to modify the terms of DCI's existing Limited Warranty applicable to all DCI products.

FCC Compliance Statement

This equipment has been tested and found to comply with the limits for a Class B digital device, pursuant to Part 15 of the Rules of the Federal Communications Commission. These limits are designed to provide reasonable protection against harmful interference in a horizontal directional drilling installation. This equipment generates, uses, and can radiate radio frequency energy and, if not installed and used in accordance with the instructions, may cause harmful interference to radio communications or inaccurate readings on your DCI locating equipment. However, there is no guarantee that interference will not occur in a particular installation. If this equipment does cause harmful interference to radio or television reception, which can be determined by turning the equipment off and on, the user is encouraged to try to correct the interference by one or more of the following measures:

- Reorient or relocate the DigiTrak® Eclipse® Receiver.
- Increase the separation between the problematic equipment and the DigiTrak® Eclipse® Receiver.
- Connect the equipment into an outlet on a different circuit.
- Consult the dealer for help.

Changes or modifications to the DCI equipment not expressly approved and carried out by DCI will void the user's Limited Warranty and the FCC's authorization to operate the equipment.

Table of Contents

SAFETY PRECAUTIONS AND WARNINGS 5

INTRODUCTION 7

SYSTEM COMPONENTS 11
- Eclipse SST Receiver 11
- Eclipse SST Remote Display and Cable Power Supply 12
- SST Transmitter and Magnetic Shield 14
- Laptop Computer with SST Software 14
- Non-DCI Components That Will Be Needed 15

STARTUP AND OPERATING INSTRUCTIONS 17
- SST Operating Procedure 17
  - Setting Up SST Laptop 17
    1. Plotting Topography, Drill Plan, and Planned Deviation 17
  - Setting Up Equipment and Site 17
    2. Establish Borepath Reference Line and Mark Borepath 17
    3. Assemble and Torque-up Non-Magnetic Housing to Non-Mag Tool 17
    4. Align Drill to Marked Borepath 18
    5. Position and Align Non-mag Tooling Assembly onto Marked Borepath 18
    6. Stage SST Equipment and Power Sources Adjacent to Tooling Assembly 19
    7. Power Up Eclipse SST Equipment 20
    8. Measure SST Transmitter Current Draw 21
    9. Install SST Transmitter into Aligned Non-mag Tooling Assembly 21
  - Setting Reference Heading (Ref Yaw) and Roll Offset 21
    10. Set Ref Yaw – Shoot Probe 21
    11. Set Roll Offset on Remote (if needed) 23
    12. Set Roll Offset on Receiver 24
  - Calibrating SST Tool and Confirming Proper System Operation 26
    13. Calibrate SST Tool to Receiver 26
    14. Measure SST Transmitter Current Draw in Housing 26
    15. Verify Pitch Readings Using Digital Level 26
    16. Connect SST Equipment to the Drill 26
  - Logging Drill Run 28
    17. Log First Point and Override Yaw Reading, If Needed 28
    18. Locate, Continue to Log and Override, If Needed 28
    19. Compensate for Differences Between Tool's Logged Position Data and Tracked Position 29
    20. Pull Back Rods, Resteer, and Relog 29
    21. Save Bore Data Occasionally 29
    22. Log Last Rod 30
    23. Save Project 30
- Summary of Basic Operating Procedure 31

Table of Contents (Cont.)

COMPUTER SOFTWARE INSTRUCTIONS 33
Starting Steering Tool Program 33
Menu Bar 34
File Menu Commands 34
Edit Menu Commands 34
Port Menu Commands 35
Help Menu Commands 35
Job Information 36
Logged Data 36
Profile Plot 37
Deviation Plot 38
Plot Area Toolbars 38
Standard Toolbar 39
Annotate Toolbar 40
COM Port Status Window and START/STOP Buttons 41
Live Data 41
Opening Project Files 43
Printing and Previewing Project Files 43
Saving Project Files 45
E-mailing Project Files 46

INPUTTING AND CHANGING DRILL DATA 47
Entering Topography and/or Drill Plan 48
Data Editor Table for Profile Plot 48
Entering or Changing Topography and Drill Plan Data in Profile Table 49
Entering Tool's Planned Deviation 50
Data Editor Table for Deviation Plot 50
Naming Blank Field for Deviation Plot 50
Entering or Changing Data for Planned Deviation Plot 50
Graphing Options 51
Changing Appearance and Location of X and Y Axes 51
Change Vertical Scale (Move X-Axis Up or Down in Profile Plot) 52
Change Horizontal Scale (Move Y-Axis to Left or Right in Profile Plot) 53
Move Axes in Deviation Plot 53
Changing Appearance of Plotted Profiles 53
Drawing and Changing Objects on Plots 54

APPENDIX: IMPORTING TOPOGRAPHY, DRILL PLAN, AND PLANNED DEVIATION FROM EXCEL FILE 57
Create Text File 57
Save Text File 58
Import Text File into SST Software 59

LIMITED WARRANTY

Safety Precautions and Warnings

Important Note: All operators must read and understand the following Safety Precautions and Warnings and must review this *DigiTrak® Eclipse® SST® Guidance System Operator's Manual* as well as the *DigiTrak® Eclipse® inGround Positioning System Operator's Manual* before using this system.

☠ Serious injury and death can result if underground drilling equipment makes contact with an underground utility such as a high-voltage electrical cable or a natural gas line.

➲ Substantial property damage and liability can result if underground drilling equipment makes contact with an underground utility such as a telephone, cable TV, fiber-optic, water, or sewer line.

🕓 Work slowdowns and cost overruns can occur if drilling operators do not use the drilling or locating equipment correctly to obtain proper performance.

- Directional drilling operators MUST at all times:
  - Understand the safe and proper operation of drilling and locating equipment, including the use of ground mats and proper grounding procedures.
  - Ensure that all underground utilities have been located, exposed, and marked accurately prior to drilling.
  - Wear protective safety clothing such as dielectric boots, gloves, hard-hats, high-visibility vests and safety glasses.
  - Locate and track the drill head accurately and correctly during drilling.
  - Comply with state and local governmental regulations (e.g., OSHA).
  - Follow all other safety procedures.
- The DigiTrak Eclipse SST system cannot be used to locate utilities.
- Continued exposure to heat, due to frictional heating of the drill head, can cause inaccurate depth to be displayed and may permanently damage the transmitter.

💣 The DigiTrak Eclipse equipment is not explosion-proof and should never be used near flammable or explosive substances.

Safety Precautions and Warnings (Cont.)

- Prior to the start of each drilling run, test the DigiTrak Eclipse SST system to confirm that it is operating properly and check that it is providing accurate drill head location and heading information and accurate drill head depth, pitch, and roll information with the transmitter inside the drill head.

- During drilling, readings will not be accurate unless:
  - The Eclipse SST receiver has been properly calibrated and the calibration has been checked for accuracy so that the receiver shows the correct depth.
  - The drill head has been located correctly and accurately and the receiver is directly above and parallel to the transmitter in the tool underground or above the front locate point (FLP).
  - The receiver height-above-ground or ultrasonic distance has been set correctly.
  - The SST transmitter remains at a distance of at least 15 ft (4.6 m) from any metal or metallic objects.

- Interference can cause inaccuracies in the measurement of depth and loss of pitch, roll, or the transmitter's location or heading.
  - Sources of interference include but are not limited to traffic signal loops, invisible dog fences, cable TV, power lines, fiber-trace lines, metal structures, cathodic protection, telephone lines, cell phones, transmission towers, conductive earth, salt water, rebar, radio frequencies, and other unknown sources of interference.
  - Interference with the operation of the remote display may also occur from other sources operating nearby on the same frequency, such as car rental agencies using their remote check-in modules, other directional drilling locating equipment, etc.

- Carefully review this operator's manual and be sure that you always operate the DigiTrak Eclipse SST system properly to obtain accurate depth, pitch, roll, yaw, and locate points. If you have any questions about the operation of the DigiTrak Eclipse SST System, please call DCI's Customer Service Department at 425-251-0559 or 800-288-3610.

REMEMBER

If you are having difficulty on the job, call DCI (425-251-0559 or 800-288-3610) and we'll attempt to help you solve the problem.

Introduction

DigiTrak® Eclipse® SST® Guidance System

The DigiTrak® Eclipse® SST® Guidance System, which is designed for tough horizontal directional drilling (HDD) projects, provides real-time tool information that enables accurate steering of the drill head. The system, also referred to as the Steering Tool, displays and records the following types of data:

- Compass heading (in tenths of a degree)
- Depth (in feet or meters)
- Lateral deviation
- Pitch (in tenths of a percent or in tenths of a degree, with updates every 1.3 seconds)
- Roll (in degrees, from 0 to 360, with updates 3 times per second)
- Temperature (in degrees Fahrenheit or Celsius)

The data is shown in real time to the drill operator on the remote display via the wireline connection. Real-time data is also displayed on the laptop computer, which can be located up to 50 ft (15 m) away from the remote display. The roll/pitch signal and depth signal, along with locate points, are also transmitted from the SST transmitter for overhead locating using the receiver. DCI recommends that you use a combination of walkover and non-walkover locating whenever possible to increase the capabilities and accuracy of the SST system.

Use of the SST system requires special non-magnetic downhole tooling, including a non-mag housing and a non-mag 15-ft (4.6-m) length of drill pipe called a monel. If a mud motor is required, a second monel will be used between the non-mag housing and the motor or bent sub.

The SST system is designed for jobs where walkover locating may not be an option, such as crossing under a river or highway. The large amount of drill data that the system records enables reliable steering. The system can also be used on projects where walkover locating *is* an option. In these cases, the SST

transmitter and special non-magnetic housing are put aside, and the battery-operated Eclipse transmitter is used with a standard housing. A standard Eclipse system can be upgraded to the Eclipse SST system.

Whether running the Eclipse SST transmitter or the battery-operated Eclipse transmitter, the *target-in-the-box*® locating feature and *look-ahead*® capability enable Intuitive® tracking of the transmitter. The receiver menu options provide quick verification of mode settings and also the ability to program the intended position of the transmitter for easier remote steering—this is DCI's *Target Steering*® feature.

To further expedite wireline connection time, the SST system can be used with the DigiTrak CableLink® Connection System. The CableLink system is preinstalled in drill rods so that the electrical connection is made when the rods are threaded up.

There are pieces of equipment, tooling, and some specialty items required for the operation of the SST system that are not supplied by DCI. Below is a list of items needed for the operation of the SST system and to make the wire connections:

- ☐ Non-magnetic housing for SST transmitter – Contact DCI for information about compatible non-magnetic housings for the SST transmitter.
- ☐ Monel (non-magnetic drill rod) approximately 15 ft (4.6 m) long for use between the non-mag housing and the first drill rod. A second monel may be required if you are using a mud motor.
- ☐ Fish tape or device to fish wire through rod
- ☐ Approximately 20 ft (6 m) of 10-gauge wire
- ☐ Butt splices for 10/12 gauge wire
- ☐ Crimper
- ☐ Heat shrinks
- ☐ Heat gun
- ☐ Transit or theodolite
- ☐ String for string line
- ☐ Tape measure
- ☐ 12V battery or power supply
- ☐ Amp meter
- ☐ Digital level

There are some important terms and procedures that are used specifically with the SST system that you should understand. These include the following:

- ➢ Yaw / Azimuth – Heading or direction with respect to the earth's magnetic field. We use yaw to refer to the heading of the transmitter with respect to the earth's North Pole.
- ➢ Reference Yaw (Ref Yaw) – Heading or direction of the SST transmitter measured when it is accurately positioned on the surveyed borepath prior to the start of the drill run. The value for the Ref Yaw is determined at the start of the SST operating procedure.
- ➢ "Shooting the Probe" – Term commonly used for the procedure of measuring the Ref Yaw using the SST transmitter (probe).
- ➢ 360 Degree Roll – Standard HDD walkover systems use a "clock" roll orientation. The SST uses a 1-degree increment roll sensor where 0° = 12 o'clock, 90° = 3 o'clock, 180° = 6 o'clock, and 270° = 9 o'clock.
- ➢ Roll Offset – Value used to compensate for the difference between the tool bit's roll orientation and the SST transmitter's roll orientation. This value is needed because the torquing process usually results in the transmitter's roll position not matching the bit's roll position.

Some terms and techniques used in this manual are considered basic to the Eclipse locating system. If you have never used the Eclipse system, DCI strongly recommends that you read the operator's manual

for the Eclipse locating system *(DigiTrak® Eclipse® inGround Positioning System Operator's Manual)* before you try using the SST system.

NOTE: You must know how to operate the Eclipse locating system prior to operating the Eclipse SST guidance system.

DCI also recommends that you read the instructions given in this SST system operator's manual and familiarize yourself with the various menu screens on your Eclipse SST receiver and remote display before using the system for a production drill. If you have questions, please call DCI's Customer Service Department at 800-288-3610 or 425-251-0559.

This operator's manual begins by describing the primary system components, including the Eclipse SST receiver, remote display, power supply, transmitter, and laptop with software. Then it presents the system startup and operating instructions, which cover the standard procedure for using the SST system. This is followed by instructions for using the Steering Tool computer software program and then detailed information for inputting and changing drill data.

The SST operating procedure is discussed in detail in the *Startup and Operating Instructions* section of the manual. The full procedure consists of the following actions:

- Setting Up SST Laptop
  1. Plotting topography, drill plan, and planned deviation
- Setting Up Equipment and Site
  2. Establish borepath reference line and mark borepath.
  3. Assemble and torque up non-magnetic housing to non-mag tool.
  4. Align drill to marked borepath.
  5. Position and align non-mag tooling assembly onto marked borepath.
  6. Stage SST equipment and power sources adjacent to tooling assembly.
  7. Power up Eclipse SST equipment.
  8. Measure SST transmitter current draw.
  9. Install SST transmitter into aligned non-mag tooling assembly.
- Setting Reference Heading (Ref Yaw) and Roll Offset
  10. Set Ref Yaw and shoot the probe.
  11. Set roll offset on remote display (if needed).
  12. Set roll offset on receiver.
- Calibrating SST Tool and Confirming Proper System Operation
  13. Calibrate SST tool to receiver.
  14. Measure SST transmitter current draw in housing.
  15. Verify pitch readings using digital level.
  16. Connect SST equipment to the drill.
- Logging Drill Run
  17. Log first point and override yaw reading, if needed.
  18. Locate, continue to log and override, if needed.
  19. Compensate for differences between tool's logged position data and tracked position.
  20. Pull back rods, resteer, and relog.
  21. Save bore data occasionally.
  22. Log last rod.
  23. Save project.

Notes

System Components

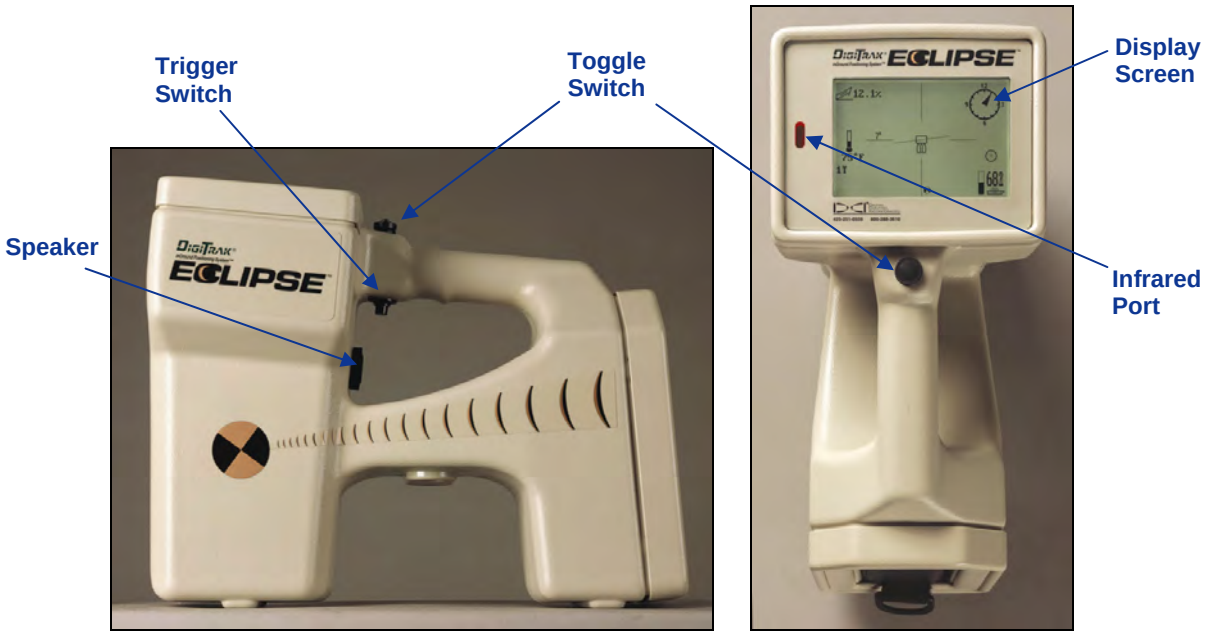
The Eclipse SST system consists of the following components:

- Eclipse SST receiver
- Eclipse SST remote display with power supply
- Eclipse SST transmitter with protective magnetic shield
- Laptop computer with SST (Steering Tool) software

This section gives descriptions of these main components.

Eclipse SST Receiver

The Eclipse SST receiver is used to walkover locate the SST transmitter when possible and to confirm computer readings. The locating procedure for the SST is the same as that for the standard Eclipse locating system, with simple two-button (trigger and toggle switch) operation. If you are not familiar with the Eclipse locating procedure, please see the Eclipse system operator's manual.



Eclipse SST Receiver Side View (left) and Top View (right)

From this point forward in this manual, the Eclipse SST receiver will often be referred to as simply the receiver. Any Eclipse receiver can be upgraded to have the SST capability.

The SST receiver menu options include those in the standard Eclipse receiver main menu in addition to a **Steering** option (see table below).

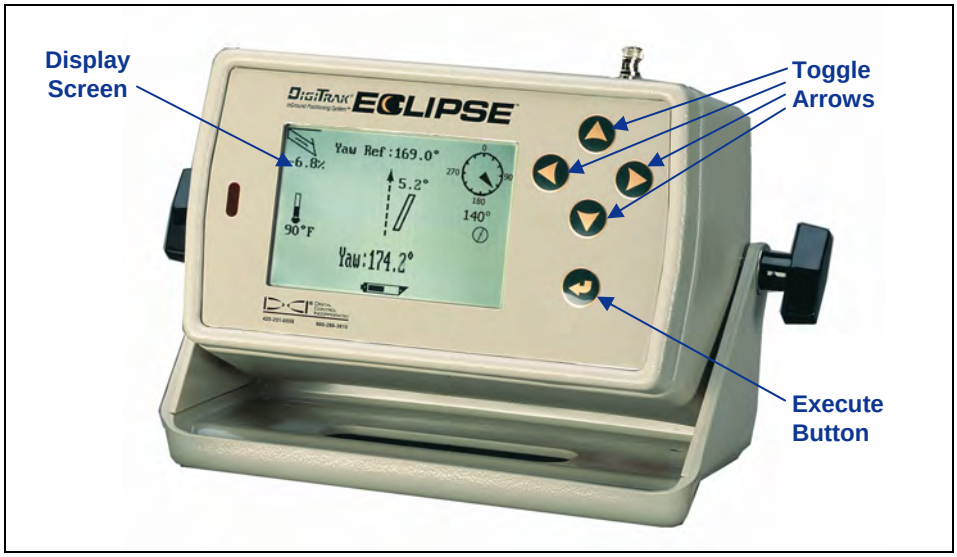
SST Receiver Menu Options

Steering	Puts the receiver into SST steering mode. This mode must be enabled to walkover track the SST transmitter. To enable steering mode, use the toggle to select **Steering**, then click the trigger. When in steering mode, the clock on the receiver display (which indicates roll) shows units in degrees (from 0 to 360), whereas in locate mode the units correspond to the numbers on a clock (1 through 12).

Eclipse SST Remote Display and Cable Power Supply

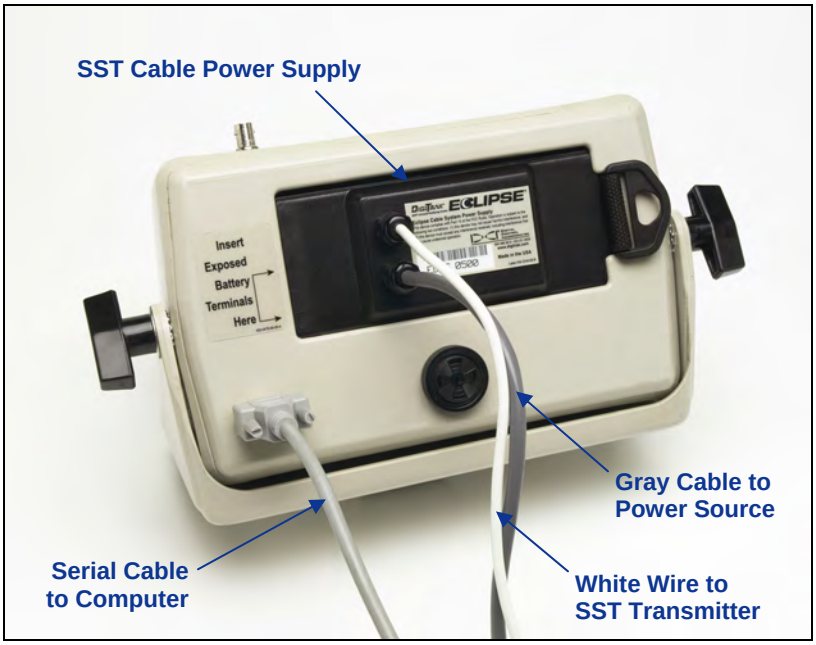
The SST remote display supplies power from the power source (drill battery) to the SST transmitter. It also receives and displays real-time information from the transmitter, including yaw (heading), pitch, roll, temperature, and battery status.

The SST remote display looks and operates much like the standard Eclipse remote display. The function buttons on the keypad (toggle arrows and execute button) operate in the same manner as on a standard remote, which is also similar to the functions of the toggle and trigger buttons on the receiver. Any Eclipse remote display can be upgraded to have the SST capability.



SST Remote Display

The SST cable power supply connects the power source, the remote display, and the transmitter. It is inserted in the back of the remote display, with the exposed terminals contacting the springs in the battery compartment. The power supply is hard wired to the SST transmitter with a 10-gauge (white) wire and to the power source with a gray cable that contains 14-gauge black ("–") and red ("+") wires.


SST Cable Power Supply
Insert Exposed Battery Terminals Here
Gray Cable to Power Source
Serial Cable to Computer
White Wire to SST Transmitter

SST Remote Display with Power Supply and Computer Connection

The SST remote display is connected to a laptop computer by means of a serial port. When connected, real-time data can be viewed at the computer, and data points can be logged by the computer operator. The SST software allows for viewing, logging, editing, graphing, saving, and printing of the drill data.

The SST remote display menu options include those in the standard Eclipse remote display main menu plus two other options: **Steering** and **Set Yaw Ref** (see table below).

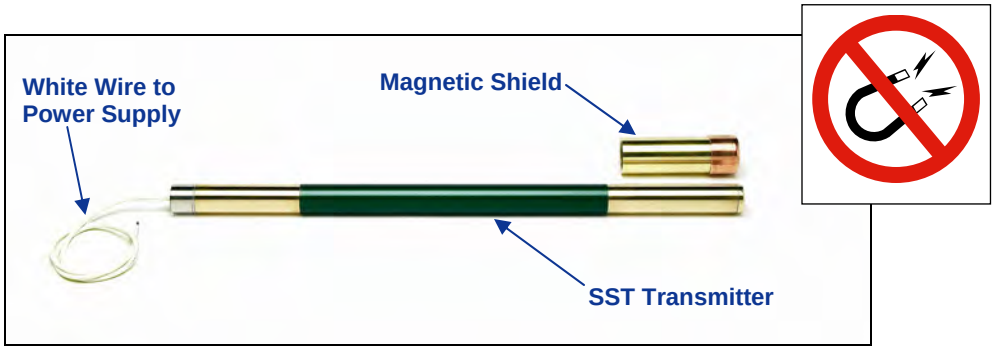
SST Remote Display Menu Options

Steering	Puts the remote display into SST steering mode. This mode must be selected when drilling with the SST transmitter. It is also used when establishing a reference heading. To enable steering mode, use the right toggle arrow to select the **Steering** option, then press the execute button. When in steering mode, the clock on the remote display (which indicates roll) shows units in degrees (from 0 to 360), whereas in remote mode the units correspond to the numbers on a clock (1 through 12).
Set Yaw Ref	This menu option is used to reprogram the SST transmitter's reference heading if the original heading is determined to be incorrect. Select this menu option and enter the reference heading by using the up/down arrows to increase or decrease the yaw number, and then press the execute button. **NOTE**: The Yaw Ref can also be set from the steering screen by pushing the up arrow (see *Operating Instructions* section).

SST Transmitter and Magnetic Shield

The Eclipse SST transmitter is similar to the standard Eclipse cable transmitter except that it also provides heading or yaw information. This information, in addition to the pitch and roll data, enables the drill operator to determine the SST transmitter's position and heading, and thus allows steering of the tool. The SST transmitter provides yaw and pitch updates every 1.3 seconds and roll updates more than 3 times per second. The SST transmitter has a changeable tail wire assembly; two spare assemblies are provided with the SST transmitter so that the assembly can be rebuilt as needed.

The SST transmitter is a magnetic-sensitive device, and it needs to be kept away from all magnetic sources. A protective magnetic shield, which is essentially a copper sleeve, is provided with the SST transmitter. The magnetic shield should be placed on the end of the SST transmitter at all times when the transmitter is not in use.



SST Transmitter and Protective Magnetic Shield

NOTE:	The SST transmitter must be kept at least 5 ft (1.5 m) away from all magnets including the remote display, which has a magnetic mount that will damage the transmitter.

Laptop Computer with SST Software

The Eclipse SST system comes with a dedicated laptop computer (PC) that has the Steering Tool software preinstalled. A USB-to-serial adapter is provided along with a 50-ft (15-m) long serial cable for connecting the computer to the remote display. A CD that contains both the Steering Tool software and this operator's manual (in a PDF file) is also provided with the system. See the next section (*Computer Software Instructions*) for more information about the software and how to use it.

NOTE:	Loading additional programs on the dedicated SST laptop could cause problems with the functioning of the SST software.

Non-DCI Components That Will Be Needed

There are pieces of equipment, tooling, and some specialty items required for the operation of the SST system that are not supplied by DCI. Below is a list of items needed for the operation of the SST system and to make the wire connections:

- ☐ Non-magnetic housing for SST transmitter
- ☐ Monel (non-magnetic drill rod) approximately 15 ft (4.6 m) long for use between the non-mag housing and the first drill rod. A second monel may be required if you are using a mud motor.
- ☐ Fish tape or device to fish wire through rod
- ☐ Approximately 20 ft (6 m) of 10-gauge wire
- ☐ Butt splices for 10/12 gauge wire
- ☐ Crimper
- ☐ Heat shrinks
- ☐ Heat gun
- ☐ Transit or theodolite
- ☐ String for string line
- ☐ Tape measure
- ☐ 12V battery or power supply
- ☐ Amp meter
- ☐ Digital level

Notes

Startup and Operating Instructions

The Eclipse SST system provides information at the remote display and the computer that enables you to make accurate (reliable) steering decisions. It also logs and saves the drill data.

This section provides detailed operating instructions for using the system. Please read over the procedure carefully and ensure that you understand all the instructions before you attempt to do it yourself.

Other components that you will need in addition to the SST system components are listed below. These items are *not* provided by DCI with the SST system, but they are needed for setting up and operating the system.

- ☐ Non-magnetic housing and monel
- ☐ Surveying equipment (transit or theodolite)
- ☐ Stakes or string for marking reference line
- ☐ Butt splices and heat shrinks for wireline connections or DCI CableLink-installed rods
- ☐ 10-gauge wire – approximately 20 ft (6 m) for use in establishing the reference heading
- ☐ Tools for crimping
- ☐ 12V battery or power supply
- ☐ Alligator clips and wire nuts to connect appropriate wires to power and ground sources
- ☐ Tape measure
- ☐ Digital level
- ☐ Amp meter

SST Operating Procedure

Setting Up SST Laptop

1. Plotting Topography, Drill Plan, and Planned Deviation

Prior to drilling, you may want to input topographic and/or planned bore information into the SST software. This information can be input during the drilling/logging process, although it is not recommended unless you have a dedicated computer operator to ensure correct and accurate input. Instructions for manually inputting this data are provided in detail later in this manual under the section titled *Inputting and Changing Drill Data*.

Setting Up Equipment and Site

2. Establish Borepath Reference Line and Mark Borepath

DCI recommends that you use surveying equipment to establish the borepath. Once, established, mark the borepath with a string line based off of the survey markers. This reference line will help in aligning the drill and non-mag tooling assembly to the intended borepath.

3. Assemble and Torque-up Non-Magnetic Housing to Non-Mag Tool

Using the drill rig or other hydraulic torquing wrenches, thread the non-mag housing to the non-mag tool and torque-up.

4. Align Drill to Marked Borepath

With the transit positioned at least 10 ft (3 m) ahead of the drill, position the drill so that the transit sights onto the center point of the drive chuck and/or centerline of the boom. Anchor the drill, and then use the transit to confirm that the drill is still aligned to the marked borepath; if not, adjust for proper alignment.

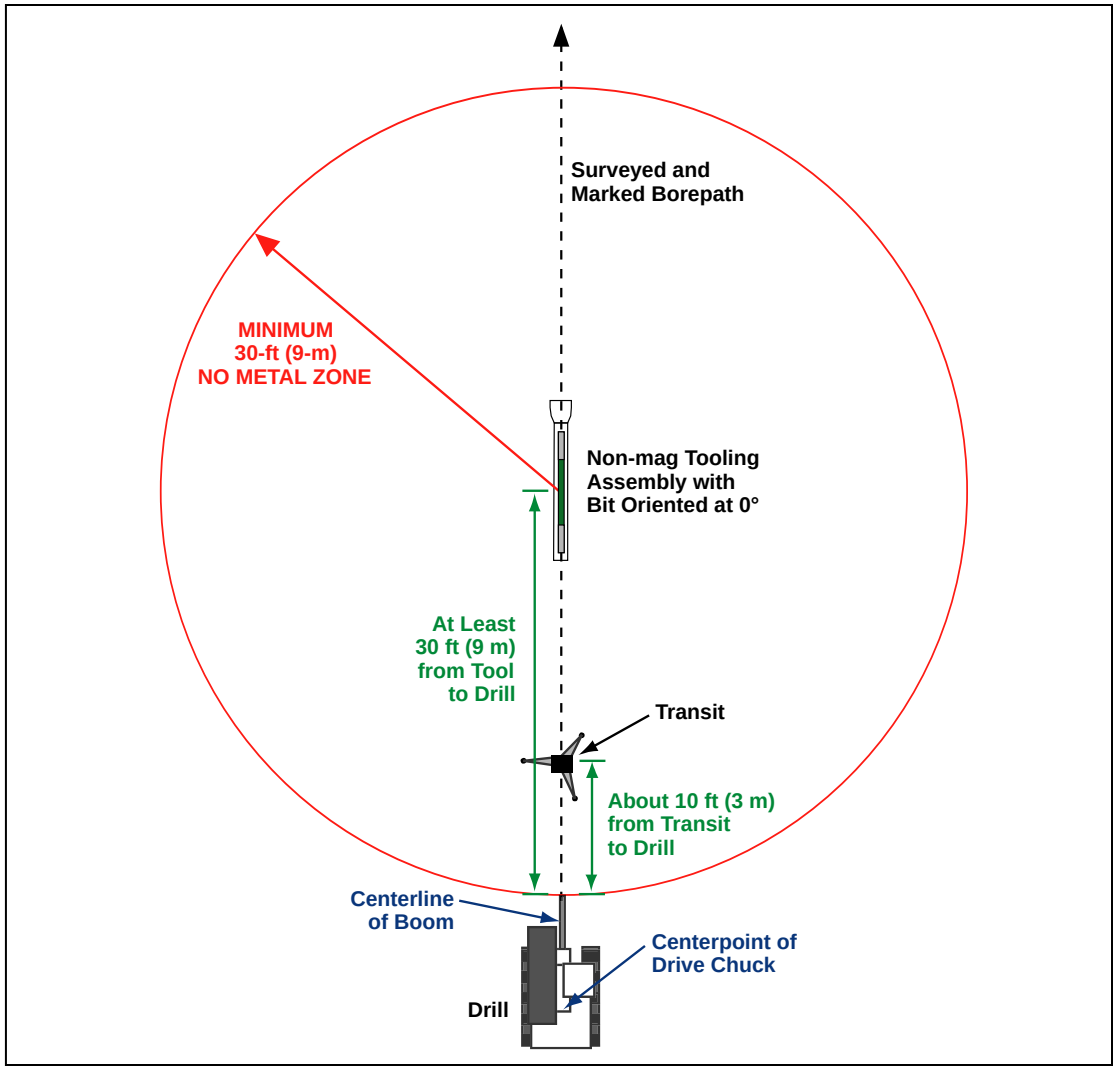
Aligning Drill to Marked Borepath

5. Position & Align Non-mag Tooling Assembly onto Marked Borepath

With the transit still in position but rotated 180°, place the tooling assembly at least 30 ft (9 m) in front of the drill, onto the marked borepath so that it is pointing in the direction of drilling with the tool or bent sub oriented to 0° (12 o'clock), as shown in the following photo and sketch. Sight the transit onto the string line and carefully align the non-mag assembly to the marked borepath.

Be sure there are no large metallic objects, including the drill, within 30 ft (9 m) of the non-mag assembly.

Aligning Non-Mag Tooling Assembly to Marked Borepath



SST Job Site Setup

6. Stage SST Equipment and Power Sources Adjacent to Tooling Assembly

In preparation for powering up the Eclipse SST equipment, position the following items adjacent to the tooling assembly:

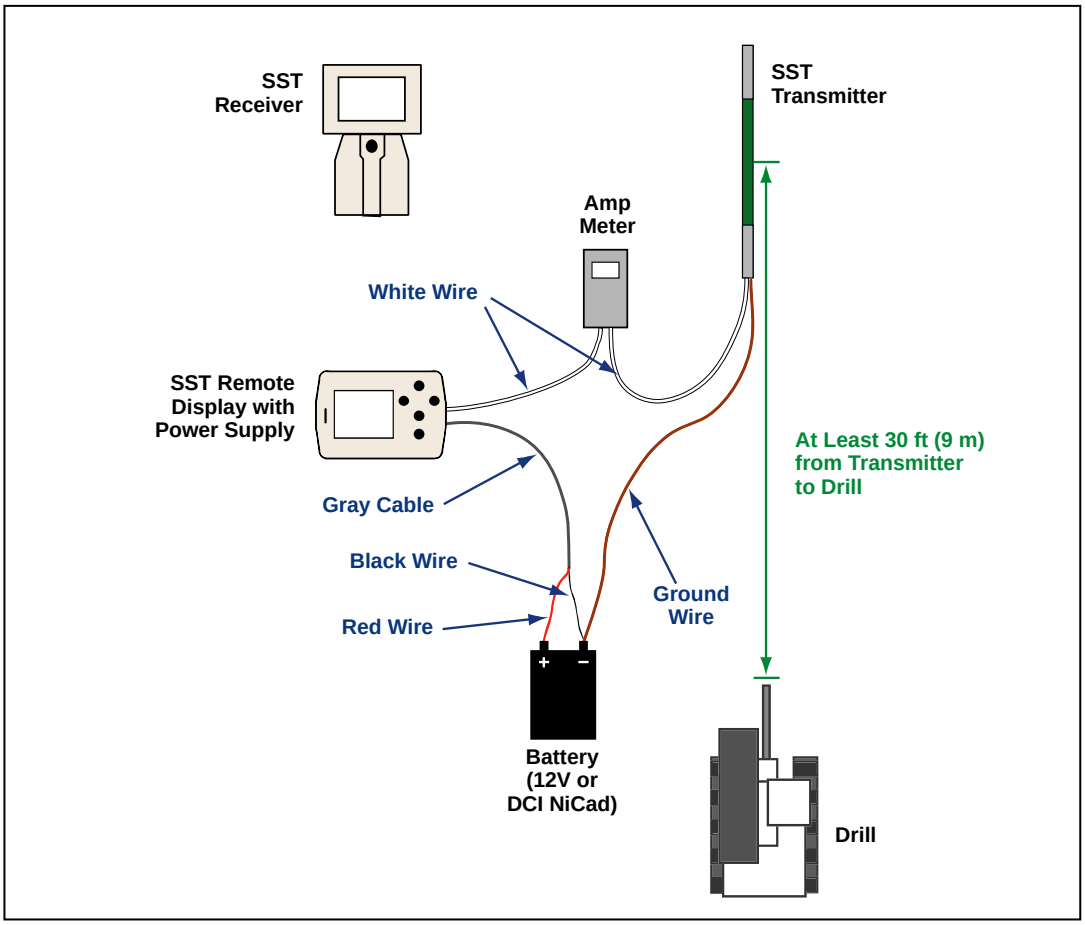
- ☐ Eclipse SST receiver
- ☐ Eclipse SST remote display
- ☐ Eclipse SST transmitter
- ☐ DCI NiCad battery for receiver
- ☐ DCI power supply
- ☐ Power source, such as a generator, 12V battery, or additional DCI NiCad battery
- ☐ Amp meter

NOTE:	Keep the remote display with its magnetic mounting bracket at least 5 ft (1.5 m) from the SST transmitter or damage to the SST transmitter could occur.

7. Power Up Eclipse SST Equipment

1. Receiver – Install a DCI NiCad battery pack and click the trigger to power up the receiver. Select **Steering** from the main menu screen.
2. Remote display – Insert DCI power supply into the back of the remote display. Do not power up the remote at this time; you will connect the SST to the power supply before powering up the remote.
3. SST transmitter – Connect the SST transmitter's wire to the power supply's white wire. Connect the black wire (in the gray cable from the power supply) to the negative terminal on the power source, and connect the red wire to the positive terminal on the power source.
4. Ground the SST transmitter – Connect the power source's negative terminal to the SST transmitter's metal end cap.
5. Power the remote display by pressing the execute button. To view data, select **Steering** from the main menu screen and press the execute button.

Verify that you see data on the remote display and the receiver.



Power Up SST Transmitter and Take Amp Reading

8. Measure SST Transmitter Current Draw

Using an amp meter hooked up in series as shown in the figure above, measure the current draw of the SST transmitter—a good reading is approximately 0.2 to 0.5 amps. The current draw will increase as the distance you drill increases. A normal current draw, for example, at 1500 ft (457 m) is about 0.7 amps. The maximum current draw you should see is approximately 1 amp.

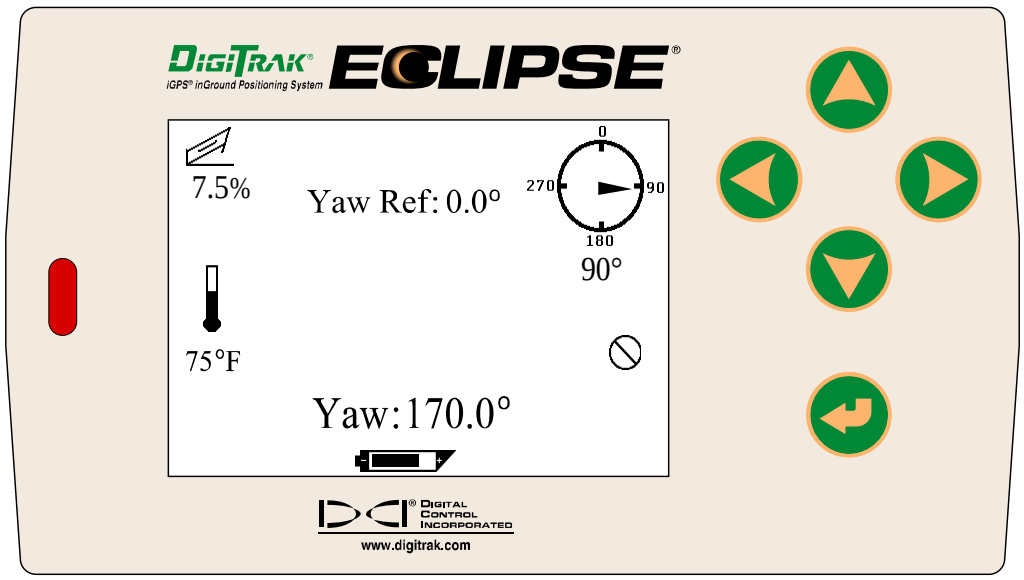
9. Install SST Transmitter into Aligned Non-mag Tooling Assembly

Install the SST transmitter into the aligned non-mag housing (tooling assembly) being sure to completely seat the SST transmitter's index slot onto the housing's internal clocking key; you should not be able to rotate the SST if it is correctly seated. Disconnect the amp meter, and reconnect the transmitter's wire to the DCI power supply's white wire. Be sure to ground the housing; this is commonly done by cutting a length of wire and touching one end to a negative battery terminal and the other end to the non-mag housing.

Setting Reference Heading (Ref Yaw) and Roll Offset

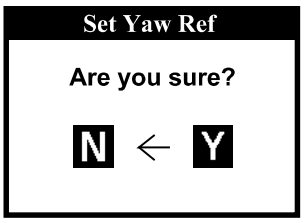
10. Set Ref Yaw – Shoot Probe

The reference heading or Ref Yaw is set on the remote display. The remote will display "Yaw Ref: 0.0°" near the top of the screen, and near the bottom it will display the current heading of the SST transmitter, which in our case is the reference heading of the intended borepath. In the example shown below, the reference heading of the intended borepath, and the heading of the transmitter, is 170.0°.



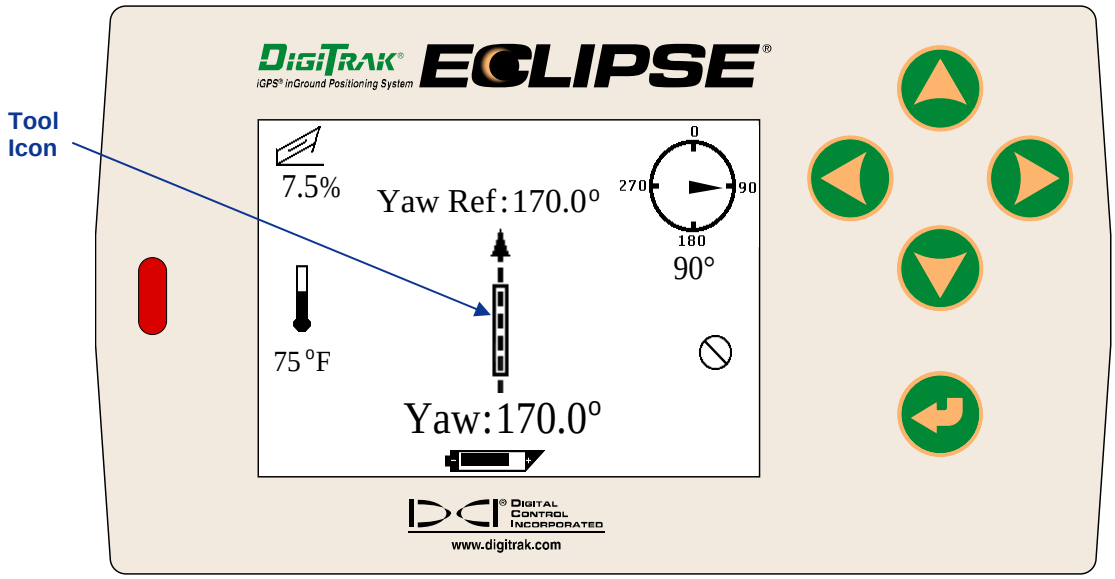
SST Remote Screen for Establishing Reference Heading

Write down this value as your Yaw Ref or reference heading. Push the remote display's up arrow. You will see the Set Yaw Ref dialog box.



Set Yaw Ref Dialog Box

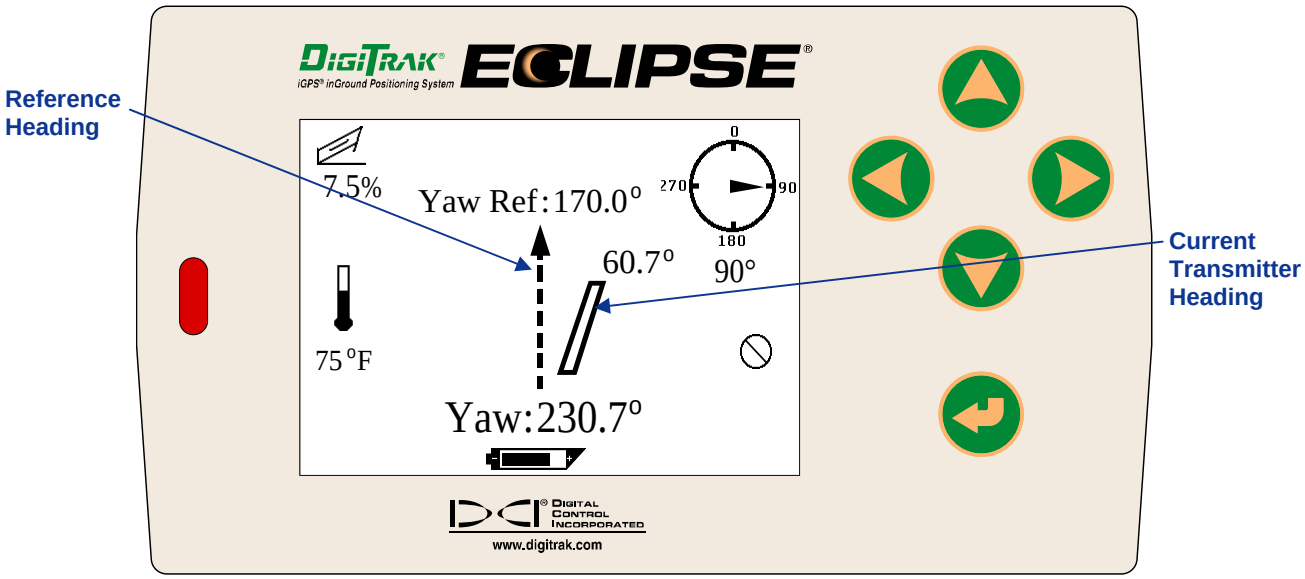
Push the right arrow to **Y** for Yes, and push the execute button. You should now see that the Yaw Ref number at the top of the screen matches the Yaw number at the bottom of the screen as shown here. The Yaw Ref and Yaw are also graphically displayed by a dashed vertical line with an arrowhead and a long rectangular box, respectively.



SST Remote Screen Showing New Reference Heading

NOTE:	If possible, take a Ref Yaw reading at a different location along the borepath, and/or at the exit location. This will allow you to determine an average Ref Yaw over the borepath and possibly identify variations in the Yaw that could result in inaccurate readings.

When the SST transmitter's Yaw does not match the Ref Yaw the tool icon will be to the left or right of the dashed line and a corresponding number will display above the tool icon to indicate the number of degrees that the SST is off line, as in the example shown below. In this case, the heading of the SST is 60.7° off of the reference heading, which means the tool needs to be steered left 60.7°.

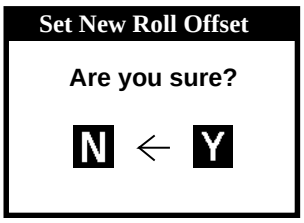


SST Remote Screen Showing Heading 60.7° to Right of Reference Heading

11. Set Roll Offset on Remote (if needed)

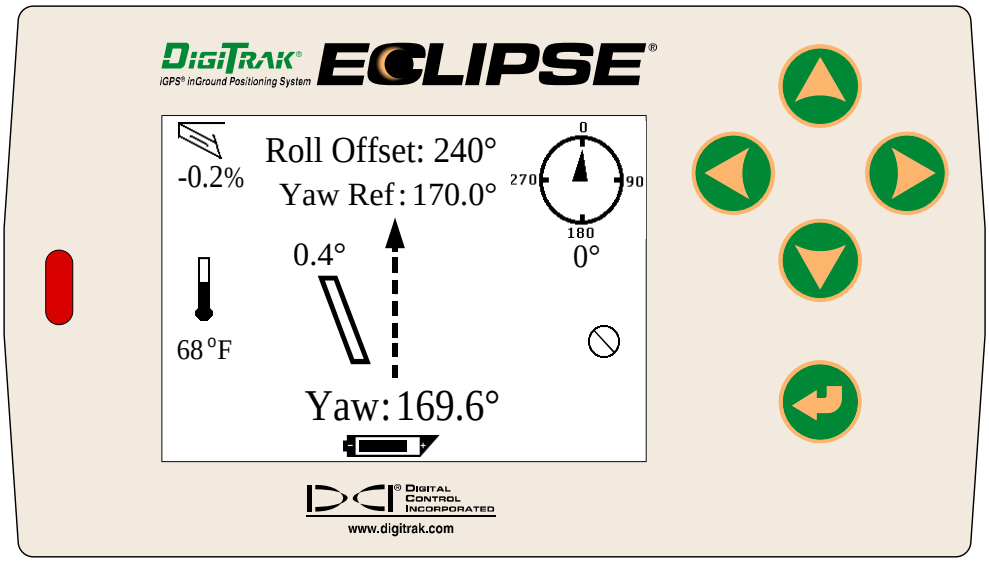
Using the remote display and the receiver, the SST transmitter's 0° roll setting can electronically be compensated if it does not match the bit's 0° roll position. To compensate for a roll difference, the receiver and remote display must have their Roll Offset functions set.

To set the Roll Offset on the remote display, push the right arrow (from the steering screen). The Set New Roll Offset dialog box will display.



Set New Roll Offset Dialog Box

Push the right arrow to **Y** for Yes and press the execute button. You will see the clock position on the remote change to read 0°, and the Roll Offset value will appear at the top of the screen (240 in this example).

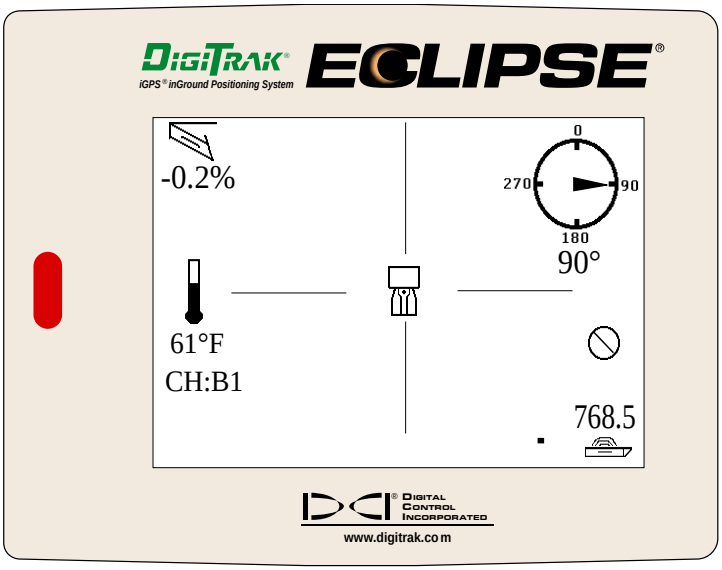


SST Remote Screen Showing New Roll Offset Value

End or Change Roll Offset on Remote – You have now set the Roll Offset on the remote display. At the end of the drill run, or during the run if you want to change the Roll Offset value, you must remove the Roll Offset value by ending the Roll Offset function. To end the Roll Offset, push the left arrow when at the steering screen, then select **Y** for Yes and press the execute button.

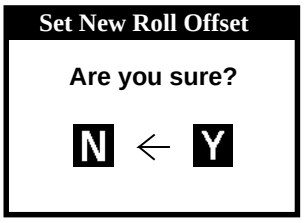
12. Set Roll Offset on Receiver

You are now ready to set the Roll Offset function on the receiver. With the receiver already in steering mode, push the toggle to the right.



SST Receiver Display for Establishing Roll Offset Value

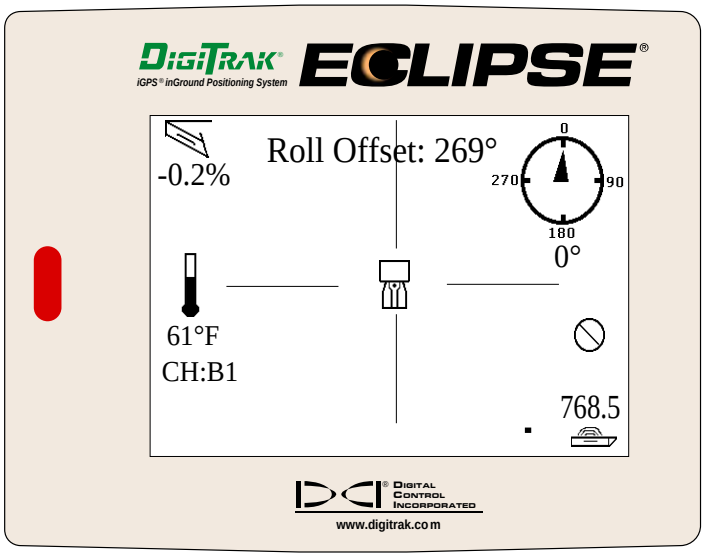
Push the toggle right to **Y** for Yes to set the new roll offset.



Set New Roll Offset Dialog Box

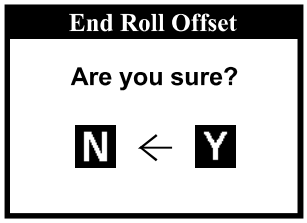
You will see the clock position on the display change to read 0°, and the Roll Offset value will appear at the top of the screen, as shown on the next receiver display.

NOTE:	To record the most accurate data from the SST transmitter, the tool should be oriented to the same roll position (or as close to it as possible) that it was at when the probe was shot, which was 0°.



SST Receiver Display Showing New Roll Offset Value

End or Change Roll Offset on Receiver – You have now set the Roll Offset on the SST receiver. At the end of the drill run, or during the run if you want to change the Roll Offset value, you must remove the Roll Offset value by ending the Roll Offset function. To end the Roll Offset, push the toggle left when at the steering screen, select **Y** for Yes, and then click the trigger.



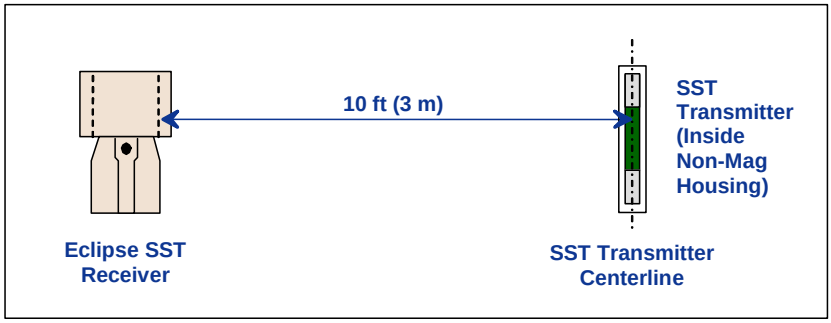
End Roll Offset Dialog Box

Calibrating SST Tool and Confirming Proper System Operation

13. Calibrate SST Tool to Receiver

In this step, you will use the receiver to conduct a high-frequency calibration, and then you will verify accurate depth readings using a tape measure.

First, ensure that there are no metal structures within 30 ft (9 m), such as steel pipe, chain-link fence, metal siding, construction equipment, or automobiles. Also make sure that the receiver is not positioned over rebar or underground utilities. Check signal strength by selecting **Steering** from the main menu screen. Position the receiver 10 ft (3 m) to the side of the SST transmitter, as shown in the figure.



10-Foot Measurement for Calibration Procedure

Verify that the signal strength at this distance is 580 to 590. Return to the main menu screen (toggle down once). Select **Configure** on the main menu screen and click the trigger. Select **1 Pt. Cal.** and follow the prompts to complete a high-frequency calibration. Return to the steering screen, and check depth readings at several locations against the tape measure.

14. Measure SST Transmitter Current Draw in Housing

Using an amp meter hooked up in series, as shown in the figure “Power Up SST Transmitter and Take Amp Reading” in step 7, measure the current draw of the SST transmitter, a good reading is 0.2 to 0.5 amps.

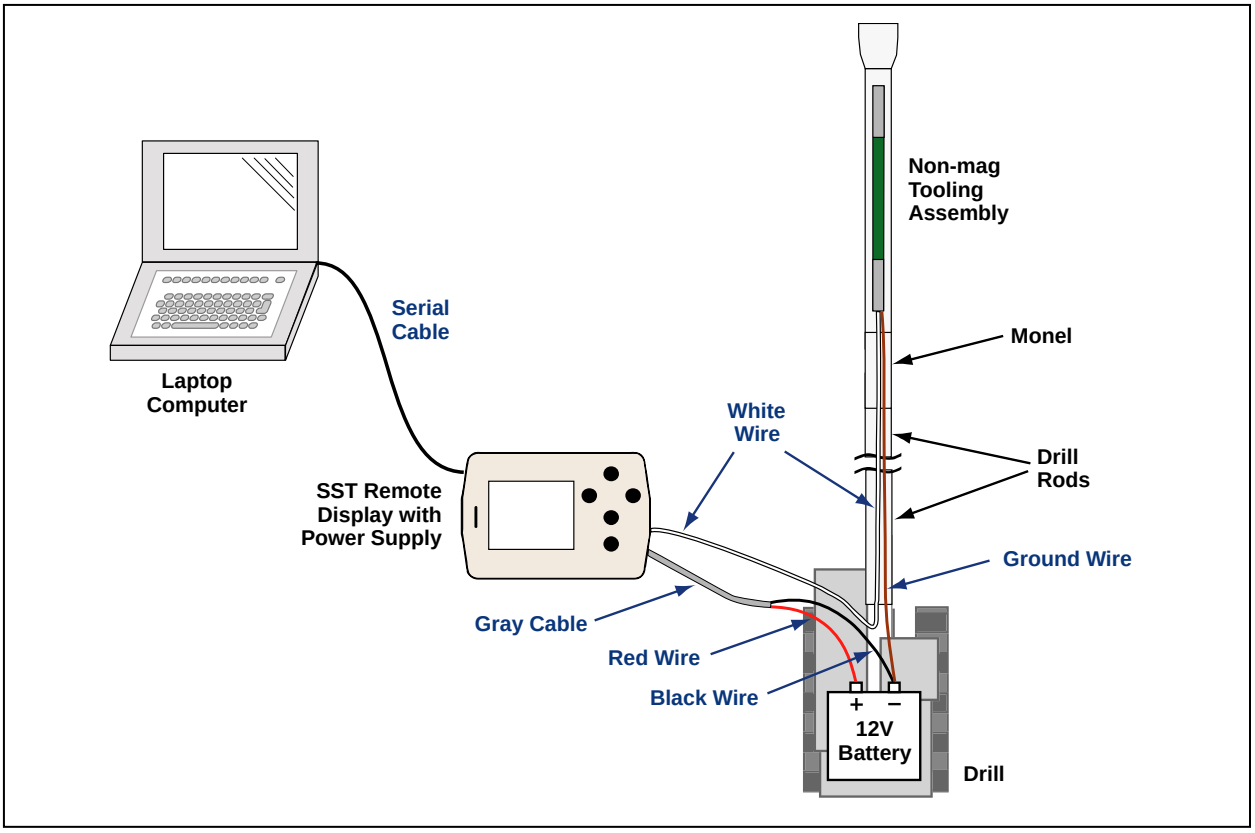
15. Verify Pitch Readings Using Digital Level

Compare the SST transmitter’s pitch readings at the remote display and the receiver with those shown on a digital level. Position the digital level on the housing, and then lift or lower the housing to different inclinations and compare the readings on the level against the remote’s and the receiver’s pitch readings to confirm accuracy.

16. Connect SST Equipment to the Drill

You are now ready to connect the SST transmitter’s 10-gauge wire to the monel’s 10-gauge wire with a butt splice and heat shrink. The monel is a non-mag drill pipe that measures approximately 15 ft (4.6 m) in length and must be used between the non-mag housing and the regular drill pipe. Once this wire connection is made, the housing can be threaded onto the monel while carefully pulling the slack in the wire to ensure that the wire does not get caught in the threads.

Depending upon how the SST transmitter's wire exits the drill pipe (through the drive chuck or the mud swivel), connect this wire to the power supply's white wire (see figure below). Connect the power supply's red wire to the positive battery terminal and the black wire to the negative terminal of the drill's battery. Power the remote display by pressing the execute button, select **Steering** from the main screen and press the execute button.



Connecting SST System Components

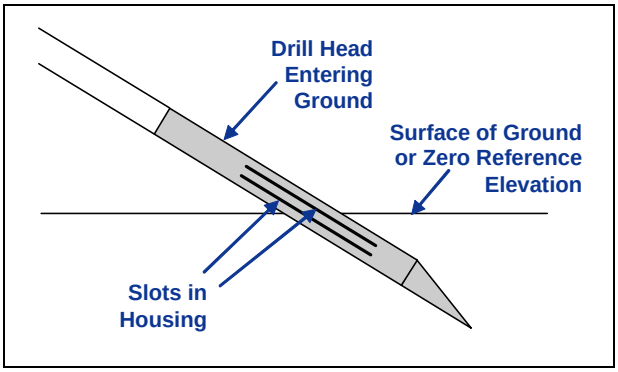
Connect the remote display to the laptop with the serial cable. The laptop can be positioned as far as 50 ft (15 m) from the drill. Power up the laptop, open the SST software, record job information using the **Edit** menu to fill in the Drill Information fields. See *Computer Instructions* and *Inputting and Changing Drill Data* sections later in this manual for complete instructions.

Open the **Port** menu option and select a port, then click on the **START** button under the COM Port Status Window. Verify that the Status Ball to the right in the window is flashing and that you see live data. If you cannot open a port, close it by clicking on the **STOP** button, then select a new port, and click on the **START** button. You can also try closing the SST application and reopening it or, if you are still having problems, rebooting the computer.

Logging Drill Run

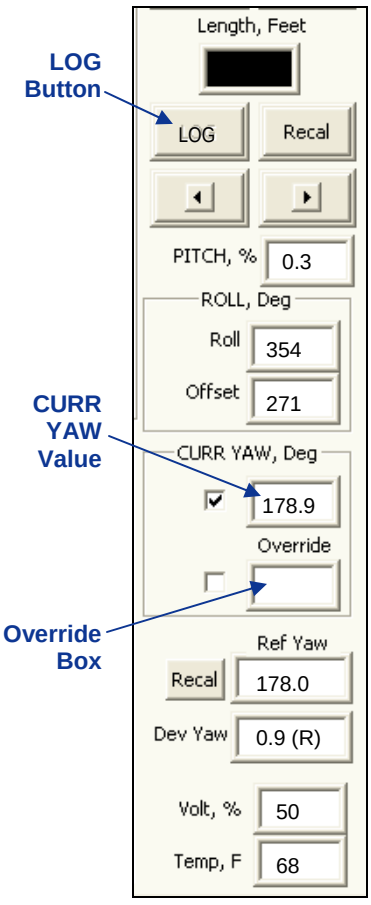
17. Log First Point and Override Yaw Reading, If Needed

The first logged point should be recorded when the SST transmitter (in the housing) is positioned so that it is ½ in and ½ out of the ground, as shown in the following diagram.



Tooling Position for First Logged Point

Once the tool is in position, press the computer's **LOG** button. If the remote display's Yaw number does not match the laptop's CURR YAW value, you may want to override the yaw on the laptop before logging. To override the yaw, click the check box to the left of the Override box, and then manually type in the Ref Yaw number. Verify that all readings are stable, and then click the **LOG** button.



18. Locate, Continue to Log and Override, If Needed

As the tool moves away from the drill, the yaw readings should match the Ref Yaw. Based on your steering commands and the tool's located position (using the receiver), you can determine if overriding the yaw is necessary or not. Be sure to wait a few seconds for all readings to stabilize before pressing the **LOG** button or overriding.

19. Compensate for Differences Between Tool's Logged Position Data and Tracked Position

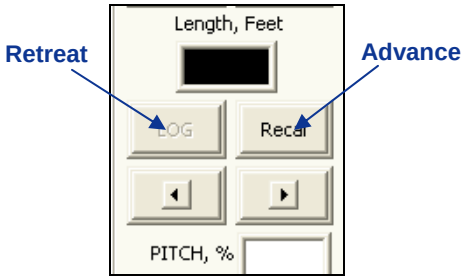
Differences between the computer's calculated position and the tool's tracked position (DEV in the laptop's Logged Data field) can occur if the first reading was not taken when the SST was ½ in and ½ out of the ground, such as when using a mud motor. In such cases, it may be necessary to compensate by changing the pitch reading. To modify the pitch reading, place your mouse on the specific row of data in the laptop's Logged Data field and double-click to view the Rod Record dialog box (see figure below). Note that, if you make a change to the data, the Rod number for that row will have an asterisk after it.

Rod Record Dialog Box

20. Pull Back Rods, Resteer, and Relog

If it is necessary to pull back and resteer the tool, you will use the pullback buttons (Retreat and Advance) in the Live Data area on the computer screen.

Every time you push the left-pointing Retreat button, you will remove the data for the last logged data point from the Profile and Deviation plots and also from the Logged Data field. If you decide to not pullback after you have retreated rods, you can press the advance button until you are back to the original position or where you want to start resteering, and the original data will reappear.



Pullback Buttons in Live Data Area

NOTE:	Be careful to be methodical when pulling back and advancing rods so that you do not hit the retreat button more times than the number of rods pulled back or advanced.

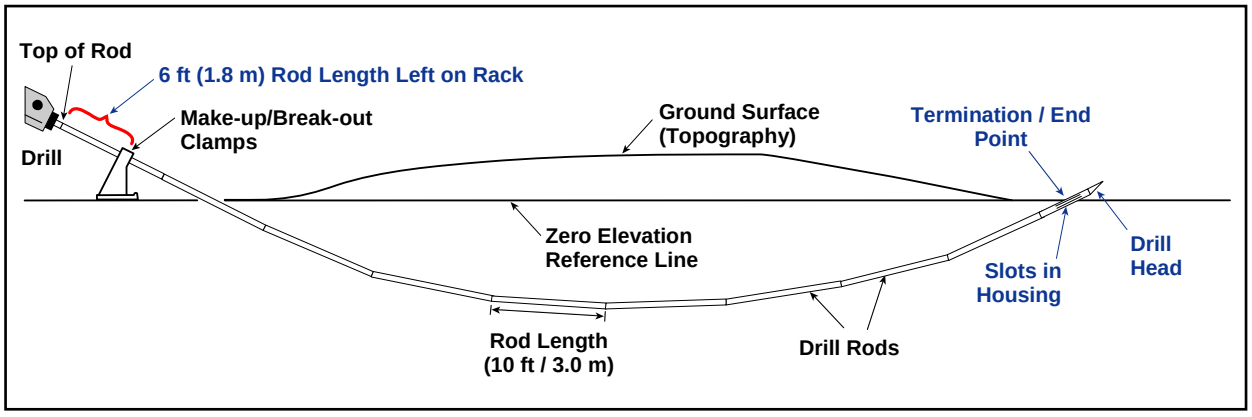
21. Save Bore Data Occasionally

DCI recommends that you save the bore data periodically during the bore. A suggestion is to include the name of the project, the horizontal distance from the launch point (x-distance), and the SST software version in the filename. For example, for a job where Pole Road is the name of the project, 880 ft is the x-distance from the launch point, and the SST software version is 2.9, an appropriate filename would be "Pole Road 880 v2.9".

22. Log Last Rod

The last rod logged is just as important as the first. At the end of the run, with the tool at the exit location, you must measure and document the length of the Last Rod so that you can enter it when you download the drill data to the computer. The **Last Rod** measurement is the rod length minus the length of drill rod left on the rack. For example, if you measure 6 ft (1.8 m) from the make-up/break-out clamps to the top of the rod, then you would subtract 6 ft (1.8 m) from the rod length. If the rod length is 10 ft (3.0 m), then the Last Rod measurement will be 4 ft (1.2 m).

> **NOTE**: If the depth of the Last Rod is less than 24 in. (61 cm), you must set the ultrasonics and log the last data point above the ground level for an accurate depth reading, or you can record pitch only.



Last Rod Measurement

23. Save Project

DCI recommends that you save the project at the end of the bore using at least two different names, so that you have an extra copy of the data for backup. Then, if you accidentally make changes you don't want, you can still revert to the earlier version of the file. You may even want to save the bore data more than two times.

When the SST software was loaded onto your computer, the default storage location was C:/Programs/ Digital Control Incorporated/Steering Tool 2.9. Within this folder will be a Drill Data folder, which is where your bore will automatically be saved.

Summary of Basic Operating Procedure

- Setting Up SST Laptop
  1. Establish borepath reference line and mark borepath.

- Setting Up Equipment and Site
  2. Establish borepath reference line and mark borepath.
  3. Assemble and torque up non-magnetic housing to non-mag tool.
  4. Align drill to marked borepath.
  5. Position and align non-mag tooling assembly onto marked borepath.
  6. Stage SST equipment and power sources adjacent to tooling assembly.
  7. Power up Eclipse SST equipment.
  8. Measure SST transmitter current draw.
  9. Install SST transmitter into aligned non-mag tooling assembly.

- Setting Reference Heading (Ref Yaw) and Roll Offset
  10. Set Ref Yaw and shoot the probe.
  11. Set roll offset on remote display (if needed).
  12. Set roll offset on receiver.

- Calibrating SST Tool and Confirming Proper System Operation
  13. Calibrate SST tool to receiver.
  14. Measure SST transmitter current draw in housing.
  15. Verify pitch readings using digital level.
  16. Connect SST equipment to the drill.

- Logging Drill Run
  17. Log first point and override yaw reading, if needed.
  18. Locate, continue to log and override, if needed.
  19. Compensate for differences between tool's logged position data and tracked position.
  20. Pull back rods, resteer, and relog.
  21. Save bore data occasionally.
  22. Log last rod.
  23. Save project.

Notes

Computer Software Instructions

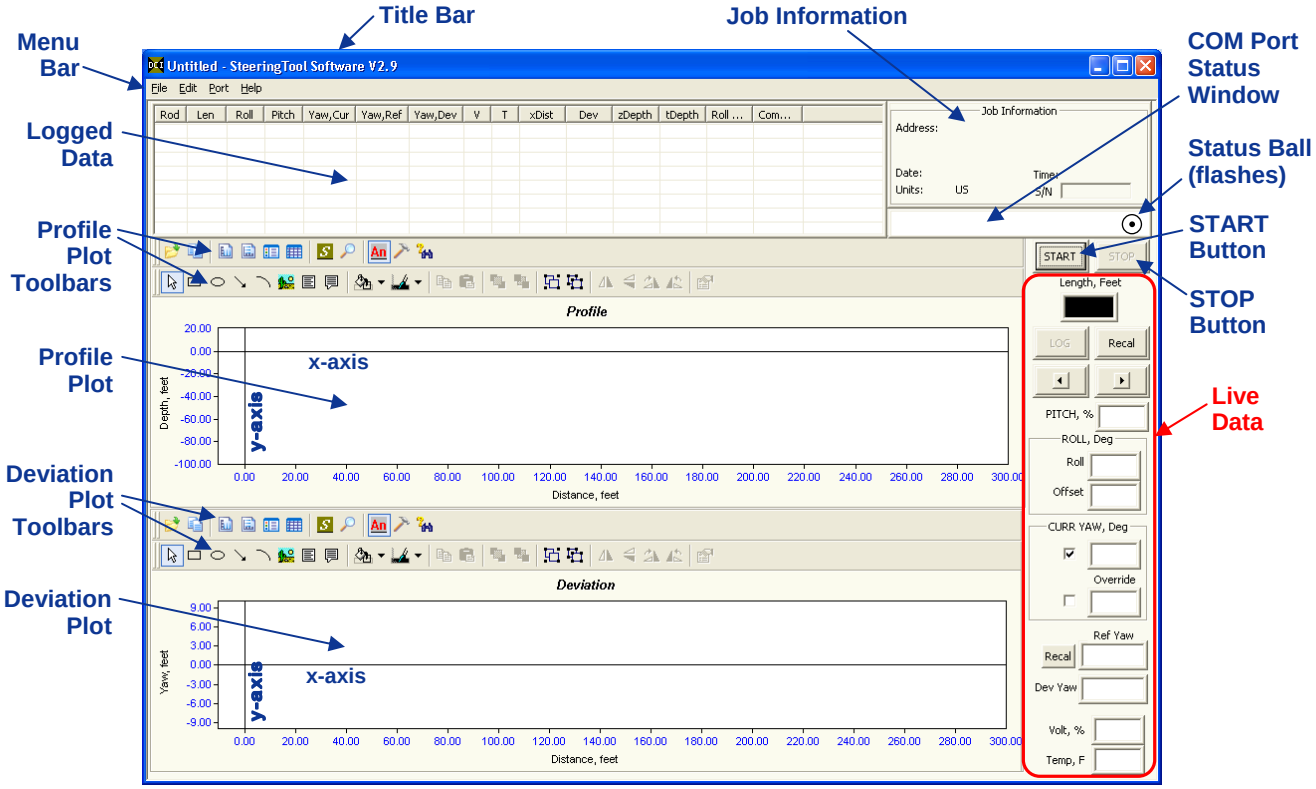
Starting Steering Tool Program

There are three ways to start the Eclipse Steering Tool program:

- Double-click on the Steering Tool icon on the desktop.
- Use the Start button and select **Start | Programs | Steering Tool | Steering Tool**.
- From Windows Explorer, click on the SteeringTool.exe file in the C:\Program Files\Digital Control Incorporated\Steering Tool folder, or the folder you have designated for the storage location.

After you start up the program, you will see the main application window (see below). This window is also generated from within the program by using the **File | New** command on the menu bar.

The Steering Tool software displays detailed information about the bore in a rod-by-rod tabular format. It also shows a two-dimensional Profile plot of the bore and a bird's-eye view of left/right deviation. The main features and information areas are identified on the picture of the main application window shown below, and then they are described in this subsection.



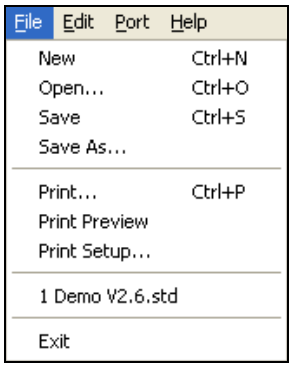
Main Steering Tool Application Window

The SST Steering Tool software contains a sample data file (Demo V2.6.std) that you can use to familiarize yourself with what the data looks like while drilling. You may want to open the sample data file and use it for an example as we discuss the software in this section.

Menu Bar

Under each menu on the menu bar (**File**, **Edit**, **Port**, and **Help**) are commands for running the Steering Tool program. Many of the commands are similar to those used in other Windows programs. This is particularly true for the **File** and **Help** menu commands. The menu commands are summarized below.

File Menu Commands



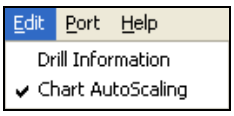
- **New** – Creates a new blank project screen.
- **Open** – Opens an existing project.

> **NOTE**: Before you open a new or existing project file by selecting **File | New** or **File | Open**, you must save the project file that is currently open. If you do not save the currently open file, it will not automatically be saved but will revert to the last saved version.

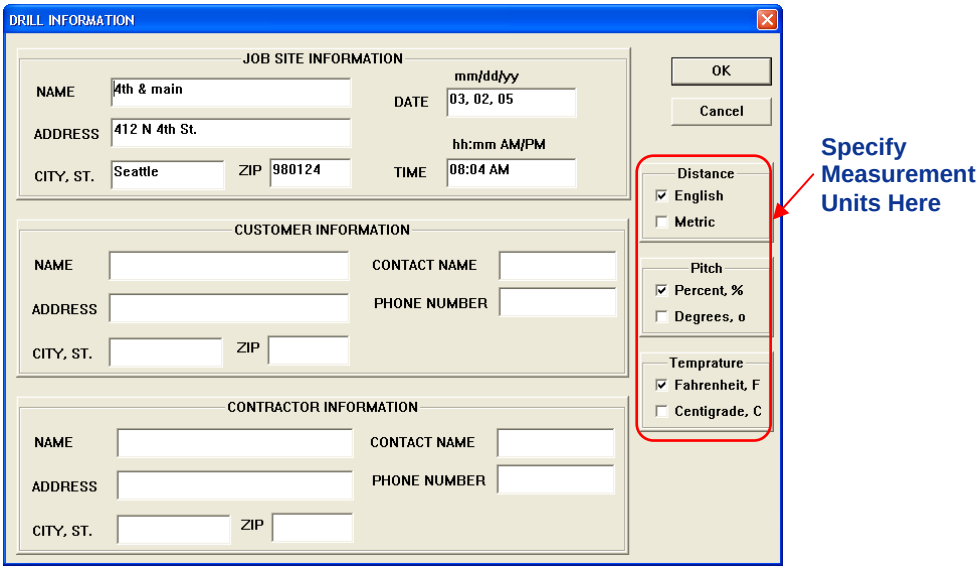
- **Save** – Saves an opened project using the same file name. If the project has not yet been saved and named, then the file will automatically save to the default file name Untitled.std in the default file location of C:\Program Files\Digital Control Incorporated\Steering Tool\Drill Data (see "Saving Project Files" later in this section).
- **Save As** – Saves an opened project to a specified file name and folder.
- **Print** – Prints a project.
- **Print Preview** – Displays the project on the screen as it would appear printed.
- **Print Setup** – Selects a printer and printer connection.
- **Exit** – Exits Eclipse Steering Tool program.

> **NOTE**: DCI recommends saving your SST data regularly and with different names.

Edit Menu Commands



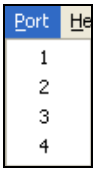
- **Drill Information** – Allows entry or editing of data in the Drill Information field, which includes job, customer, and contractor data. The Drill Information dialog box is also where measurement units are specified. If units are not specified here, the SST system will use the default units of English (feet) for distance, percent for pitch, and Fahrenheit for temperature.



Drill Information Dialog Box

- **Chart Autoscaling** – Allows you to keep the entire Profile and Deviation points viewable during the logging of a run. If Chart Autoscaling is not checked, then the Profile and Deviation plots will go "off the chart," or outside the viewable area. This feature may be useful if a run is very long.

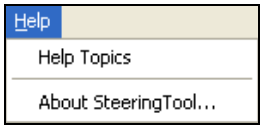
Port Menu Commands



The **Port** menu has four options, which are listed as **1**, **2**, **3**, and **4**. These numbers represent the serial (COM) ports available. The **Port** menu is used to select a COM port for connecting the computer to the remote display to receive the SST transmitter's data.

For more information on how to connect the remote display to a port on your computer, see "COM Port Status Window and START/STOP Buttons" later in this section.

Help Menu Commands



- **Help Topics** – Opens Eclipse Steering Tool Help file.
- **About Steering Tool** – Provides software version number and copyright information for Eclipse Steering Tool software.

Job Information

The Job Information field contains information about the project/bore including the address, date, time, pitch units (degrees or percent slope), and depth units (metric or feet). The information is entered in this field by clicking on **Edit | Drill Information**, and then clicking the checkboxes in the right column of the Drill Information dialog box to indicate your choices for units. If you do not define the depth or pitch units, the default setting of percent and feet will be used.

Logged Data

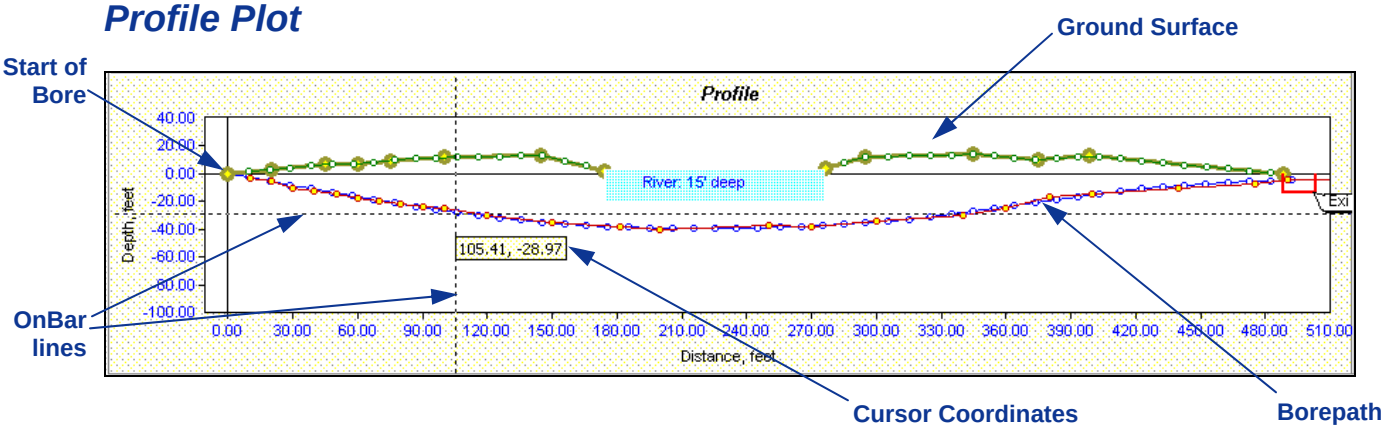
Rod	Len	Roll	Pitch	Yaw,Cur	Yaw,Ref	Yaw,Dev	V	T	xDist	Dev	zDepth	tDepth	Roll Offset	Comments
0	0	335	-32.2	178.9	178.6	0.3 (R)	50	75	0	0	0	0	47	
1	10.00	335	-32.2	178.9	178.6	0.3 (R)	50	75	9.52	0.05	-3.07	-5.94	47	
2	10.00	335	-32.1	178.9	178.6	0.3 (R)	50	75	19.04	0.10	-6.13	-7.73	47	
3	10.00	334	-32.1	178.9	178.6	0.3 (R)	50	75	28.56	0.15	-9.18	-13.58	47	
4	10.00	335	-32.2	178.9	178.6	0.3 (R)	50	75	38.08	0.20	-12.24	-16.76	47	
5	10.00	333	-32.5	179.0	178.6	0.4 (R)	50	75	47.59	0.26	-15.32	-15.32	47	
6	10.00	340	-33.8	178.6	178.6	0.0	50	75	57.09	0.29	-18.47	-18.47	47	
7	10.00	340	-33.5	178.6	178.6	0.0	50	75	66.56	0.29	-21.66	-21.66	47	

The Logged Data field contains 15 columns of rod-by-rod drill data about the bore. The type of data provided under each column heading is described below.

- **Rod** – A sequential listing of data for each logged point or rod. Because the distance between logged points can vary to accommodate different drilling conditions, the number of logged points will not necessarily match the number of actual rods drilled. For example, when considerable pitch changes occur, it is best to log data several times along one or more rods. An asterisk ("*") will appear next to the rod number if the data for that rod has been changed in the computer.
- **Len** – Typically the length of one drill rod or the distance between data recordings. **Len** can be changed as needed to compensate for logging more than one data point on a long (30-ft [9-m]) rod or when there are considerable pitch changes, such as at the beginning or the end of a bore. This enables a more accurate calculation of the transmitter's depth. This value is the same as that appearing in the **Length** box in the Live Data field (see "Live Data" later in this section).
- **Roll** – The roll position displayed in degrees from 0 to 360, where 12 o'clock is equal to 0°, 3 o'clock is equal to 90°, 6 o'clock is equal to 180°, and 9 o'clock is equal to 270°.
- **Pitch** – The inclination of the transmitter displayed in percent or degree increments. This setting can be changed using the **Edit | Drill Information** menu option.
- **Yaw, Cur** – The current yaw or heading of the SST transmitter displayed in degrees when the data was logged.
- **Yaw, Ref** – The reference heading of the intended borepath (when you shot the probe). The reference heading can be changed if necessary at the remote display or on the laptop.
- **Yaw, Dev** – The difference between the current yaw and the reference yaw displayed in degrees. Positive deviation is to the right and negative deviation is to the left of the reference yaw.
- **V** – The status of the above-ground battery powering the SST transmitter in percent of power remaining. A low battery has 12V or less remaining; a full battery has 24V.

- **T** – The temperature of the SST transmitter in degrees Fahrenheit, when using English units (feet), or in degrees Celsius, when using metric units.
- **xDist** – The transmitter's horizontal distance from the launch point. Note that this is not the length of the actual borehole. This value is measured along the x-axis.
- **Dev** – The transmitter's lateral (left/right) distance from the borepath's reference heading, displayed in either feet or meters. A positive value is to the right and below the x-axis in the Deviation plot.
- **zDepth** – The depth of the transmitter displayed in either feet or meters. This value may be above or below the x-axis or drill rig elevation (which is the zero elevation line).
- **tDepth** – The total depth of the transmitter measured from the topography that has been manually entered using the Data Editor (see *Inputting and Changing Drill Data* section) or imported from an Excel file (see *Appendix: Importing Topography Drill Plan and Tool Deviation*). If no topography data has been entered manually, the tDepth will be the depth below the zero elevation line, and it will be the same as the zDepth.
- **Roll Offset** – The value (in degrees from 0 to 360) used to compensate for the difference between the tool bit's roll orientation and the SST transmitter's roll orientation.
- **Comments** – Information can be added in the Comments column by double-clicking on the row where you want to add a comment to display the Rod Record dialog box, where you can enter a comment.

Profile Plot

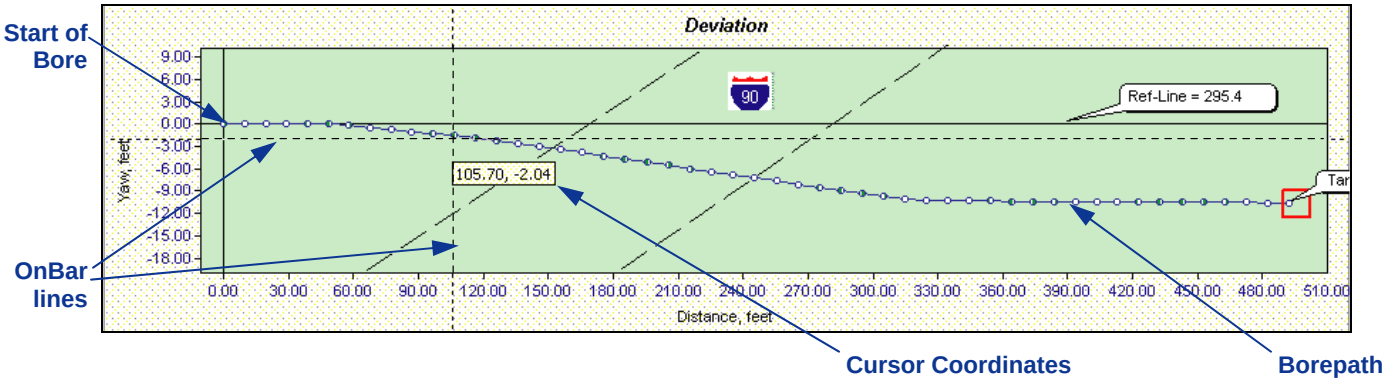


The Profile plot area shows the bore's progress in a two-dimensional Profile view. As the bore progresses, and more data points are logged, an automatic scaling feature formats the plot area so that the entire bore remains viewable and does not go "off the chart" (see Chart Autoscaling under "Edit Menu Commands" earlier in this section). If you place the mouse pointer or cursor anywhere in the plot area and then hold down the left mouse button, you will see dashed vertical and horizontal lines that intersect at the cursor location and a pop-up box that displays the cursor coordinates. This location and the dashed lines are referred to as the OnBar.

In the Profile plot shown above, the cursor location is at the intersection of the two dashed OnBar lines. The numbers in the pop-up box (105.41, -28.97) correspond to the cursor coordinates.

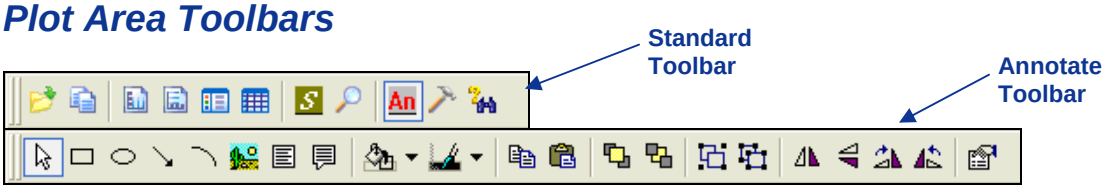
The cursor can also be positioned on the logged points for additional data.

Deviation Plot



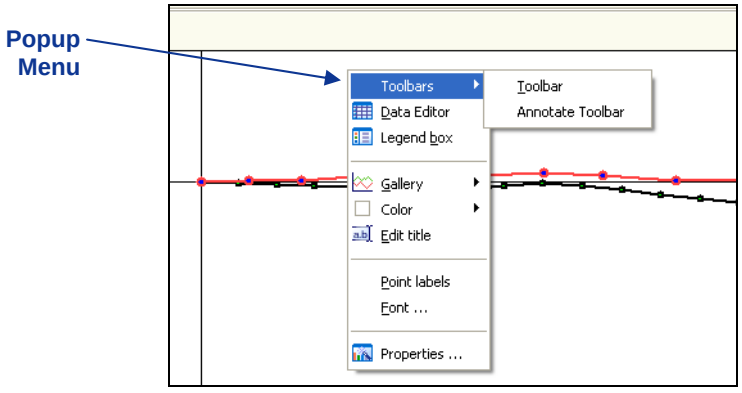
The Deviation plot area shows the lateral (left/right) deviation of the transmitter from the reference line. The plot is at the same horizontal position as the Profile plot, but from a bird's-eye view. As with the Profile plot, this window has an automatic scaling feature to keep the plot "on the chart." The OnBar lines and cursor coordinates will appear whenever you place the cursor anywhere in the chart area and hold down the left mouse button.

Plot Area Toolbars



When you open the SST software, you should see two rows of icons above both the Profile and Deviation plot areas. The upper row is the standard toolbar, and the lower row is the annotate toolbar. The standard toolbar allows you to do a variety of functions with the drilling data, and the annotate toolbar primarily provides drawing and formatting tools to customize the appearance of the information in the plot area.

Access Toolbars – If you do not see the toolbars, place the cursor in either the Profile or Deviation plot area and right click to view a popup menu (as shown in the graphic below). Click on the Toolbars option, then click either Toolbar or Annotate Toolbar to display that toolbar above the plot area.

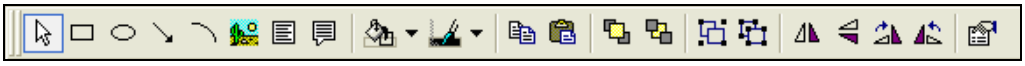


Standard Toolbar

The icons available on the standard toolbar are briefly described below. For details on how to use them, see “Graphing Options” in the *Inputting and Changing Drill Data* section.

Import Topography	Enables the import of topographic data from an Excel file.
Copy to Clipboard	Copies data as a bitmap, metafile, or text file to the clipboard to save in another format.
Vertical Grid	Displays vertical grid lines on the graph.
Horizontal Grid	Displays horizontal grid lines on the graph.
Series Legend	Displays the four graphed plots (Tool Depth, Topography, Interpolated Topography, and Drill Plan) with their symbols in a legend box, which is by default at the bottom of the Profile plot area.
Data Editor	Allows manual entry of topographic and planned bore data.
AutoScale Charts	Keeps entire drill path and topo on the screen.
Zoom	Allows you to zoom in on areas of the graphs by clicking and dragging the mouse to define a zoom area.
Annotate ToolBar	Displays the annotate toolbar below the standard toolbar, or closes it if it is already displayed.
Tools	Provides another means to access some toolbar functions as well as the PaletteBar and the PatternBar.
Search	This function does not work in the SST software.

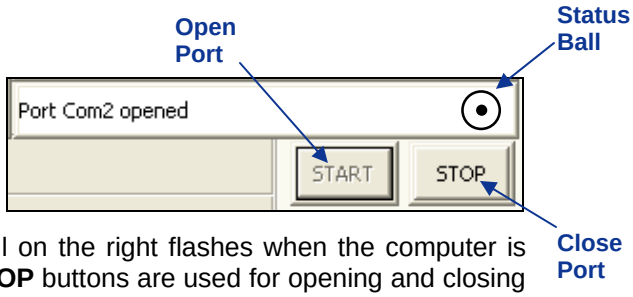
Annotate Toolbar



The icons available on the annotate toolbar are briefly described below. These icons enable functions similar to those provided in standard drawing applications. For details on how to use them, see “Graphing Options” in the *Inputting and Changing Drill Data* section.

Pointer	Allows cursor to be used as a selection tool and shows OnBar and coordinates for cursor point when left mouse button is clicked.
Rectangle	Used to draw a square or rectangle in the plot area.
Circle	Used to draw an oval or circle in the plot area.
Arrow/Line	Used to draw an arrow or line in the plot area.
Arc	Used to draw a curved line in the plot area.
Picture	Pastes artwork for another application.
Text Box	Inserts text box in plot area and enables text to be typed in it.
Balloon with Text	Inserts balloon-type text box in plot area and enables text to be typed in it.
Background Color	Used to change the color of the background in the plot area.
Foreground (Border) Color	Used to change the color of the foreground or border in the plot area.
Copy	Copies selected item to clipboard.
Paste	Pastes item that has been copied to the clipboard.
Bring to Front	Brings selected item to the front of other objects.
Send to Back	Sends selected item to the back of other objects.
Group	Groups selected objects.
Ungroup	Ungroups selected group.
Flip Vertical	Flips object along its vertical axis.
Flip Horizontal	Flips object along its horizontal axis.
Rotate Right	Rotates selected object in clockwise direction in 90° increments.
Rotate Left	Rotates selected object in counterclockwise direction in 90° increments.
Properties	Opens properties dialog box for the selected object.

COM Port Status Window and START/STOP Buttons

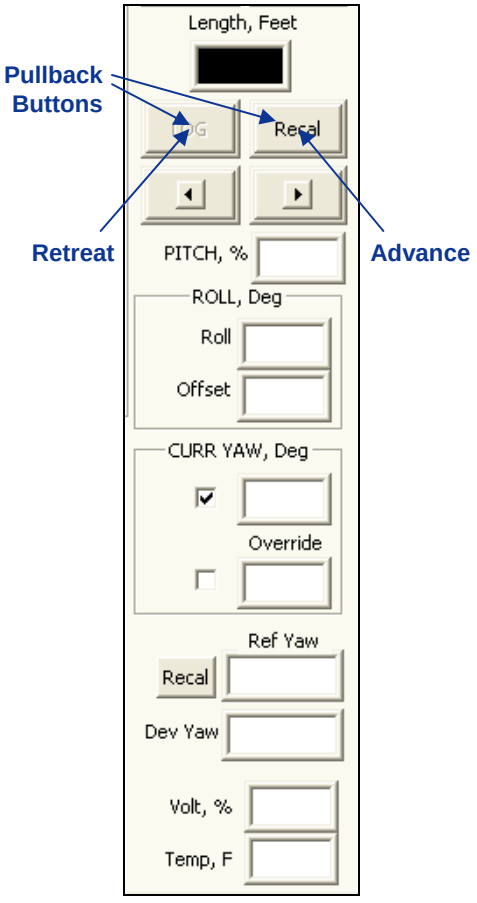


The COM Port Status Window indicates whether a COM (serial) port is open and connecting the computer to the SST transmitter through the remote display. The Status Ball on the right flashes when the computer is receiving data from the SST transmitter. The **START** and **STOP** buttons are used for opening and closing a port.

A COM port must be open before bore data can be logged. To open a COM port, select **Port** from the menu bar, and then select one of the four options (**1**, **2**, **3**, or **4**). COM port 1 is typically selected. Click on the **START** button, and, if the SST transmitter is connected and functioning, you will see the status ball begin to flash and a message showing that a COM port is open. To disconnect from a port, click on the **STOP** button.

To determine the computer's available ports, open your computer's Control Panel and click on the System icon to open the System Properties dialog box. Click on the Hardware tab and then the Device Manager option at the top to open the Device Manager dialog box. Click on "Ports" in the listing to view the available ports on your system. You can select each port individually to see if it will open and function. The open port will only function when live data is being received from the SST transmitter.

If you cannot open a port after you have identified one using your computer's system properties hardware settings in the Control Panel, close the Eclipse Steering Tool program and reopen it. Select the desired port, and click on the **START** button. If this does not solve the problem, then call DCI Customer Service, for assistance.



Live Data

This area of the application window displays live data from the SST transmitter when it is powered up and the computer is connected to the remote display. The types of information displayed are described below, starting at the top of the data area.

- **Length, Feet** – An input box for the distance between logged points (with units shown based on options selected in the Job Information field). This distance must be typed in before you can log data. The length is typically the length of one drill rod. It may be advisable to record data at shorter intervals, particularly if considerable pitch changes occur. This field will default to the most recent length entered, so be sure to correct the value in this box if you have changed the distance between log points. You can change the length setting at any time by simply clicking the cursor in this box and then typing in the desired length.
- **LOG Button** – Used to log data. This button can only be activated when a COM port is open and the computer is receiving data from the SST transmitter. To log data, press the **LOG** button—the new data will appear in the Logged Data field, and the Profile and Deviation plots will automatically update. Always verify accuracy of Live Data prior to logging. Be sure to orient the tool to 0° and wait 10 seconds to ensure stable, accurate data.

- **Recal Button** – Used to redraw or refresh the graph if data has changed.
- **Pullback Buttons –** Used to pull rods backward (retreat) or forward (advance) in the computer program. The left arrow button is used when the tool is pulled back for redirection. When you press the left arrow button, the data for the pulled back rod will disappear and the Profile and Deviation plots will get shorter. When you press the right arrow button, the data will reappear and the Profile and Deviation plots will get longer.

  When tool redirection (pullback) is required, press the left arrow until the appropriate number of rods has been "pulled back". Be sure to communicate with the drill operator to ensure that the same number of rods is pulled back. As the bore is redrilled, you will press the **LOG** button to log the redrilled rods. When you do this, you will no longer see or have access to the old rod data (or portions of the Profile and Deviation plots) because you have now "logged over" the old data.

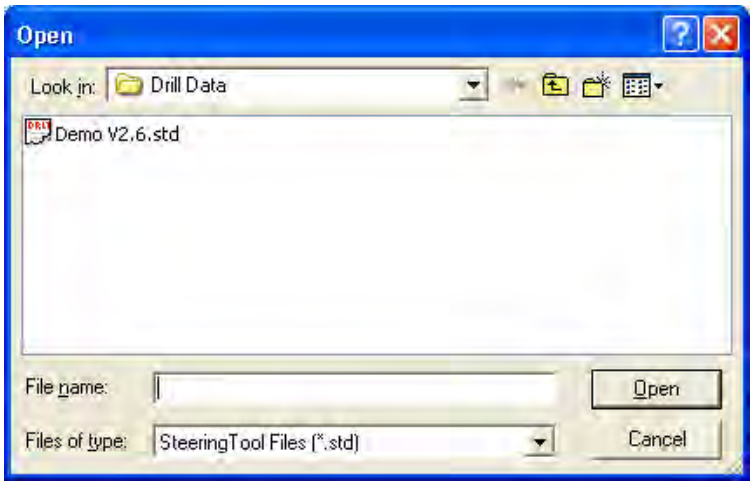
  NOTE: It is recommended that, before pulling back rods, you save data as a different file name, such as Bore1Rev1, Bore1Rev2, etc. (see "Saving Project Files" later in this section). It is also recommended that, prior to drilling and pulling back, you make a rod count.
- **PITCH, %** – Displays the current pitch of the transmitter, in either percent or degrees (depending upon the units selected in the Job Information field).
- **ROLL, Deg** – Displays the current roll and roll offset positions for the transmitter, in degrees.
- **CURR YAW, Deg** – Displays yaw (heading) information for the transmitter. This field contains two checkboxes and two data input boxes. A check mark will appear in the top box, with the current heading of the transmitter in the adjacent data input box. If it is determined that this information is not correct, due to a localized interference source, it is possible to override the current yaw setting to one that is believed to be correct. To override the current yaw, click on the second checkbox (to enter a checkmark), and then enter the appropriate yaw value in the adjacent data input box labeled Override.

  NOTE: Yaw readings may vary with roll orientation. Always use the same roll position to log data or click the checkbox next to the Override input box.
- **Ref Yaw** – Displays the reference heading established when you shot the probe. This is provided as a quick comparison to the CURR YAW described above. The value is identical to the value for Yaw, Ref in the logged data.

  The Ref Yaw gets recorded on the laptop when the first data point is logged. The information is sent from the remote display, where it is called the Yaw Ref. The Ref Yaw can be changed at any time on the laptop as required; it can also be changed on the remote display.
- **Ref Yaw Recal Button** – This will redraw the graph if the Ref Yaw is changed.
- **Dev Yaw** – Displays the left/right deviation of the SST transmitter measured in degrees. This value is the difference between the Ref Yaw and CURR YAW. The value is identical to the value for Yaw, Dev in the logged data. Positive values to the right, negative values to the left.
- **Volt, %** – References the input voltage, 12V to 24V DC.
- **Temp, F** – Displays the temperature of the SST transmitter in degrees Fahrenheit, if English units are being used, or in degrees Celsius, if metric units are being used. Normal drilling temperature ranges are 60–82°F (16–28°C)

Opening Project Files

1. To open an existing drill project from within the Steering Tool program, select **Open** from the **File** menu. You will see the Open dialog box and a list of available project files (with the file extension "std") in the folder that was last used. If this is the first time the program is being used, the Open dialog box will show the Drill Data folder under the Steering Tool program file with only one file, Demo V2.6.std. The default location for storing project files is C:\Program Files\Digital Control Incorporated\Steering Tool\Drill Data.



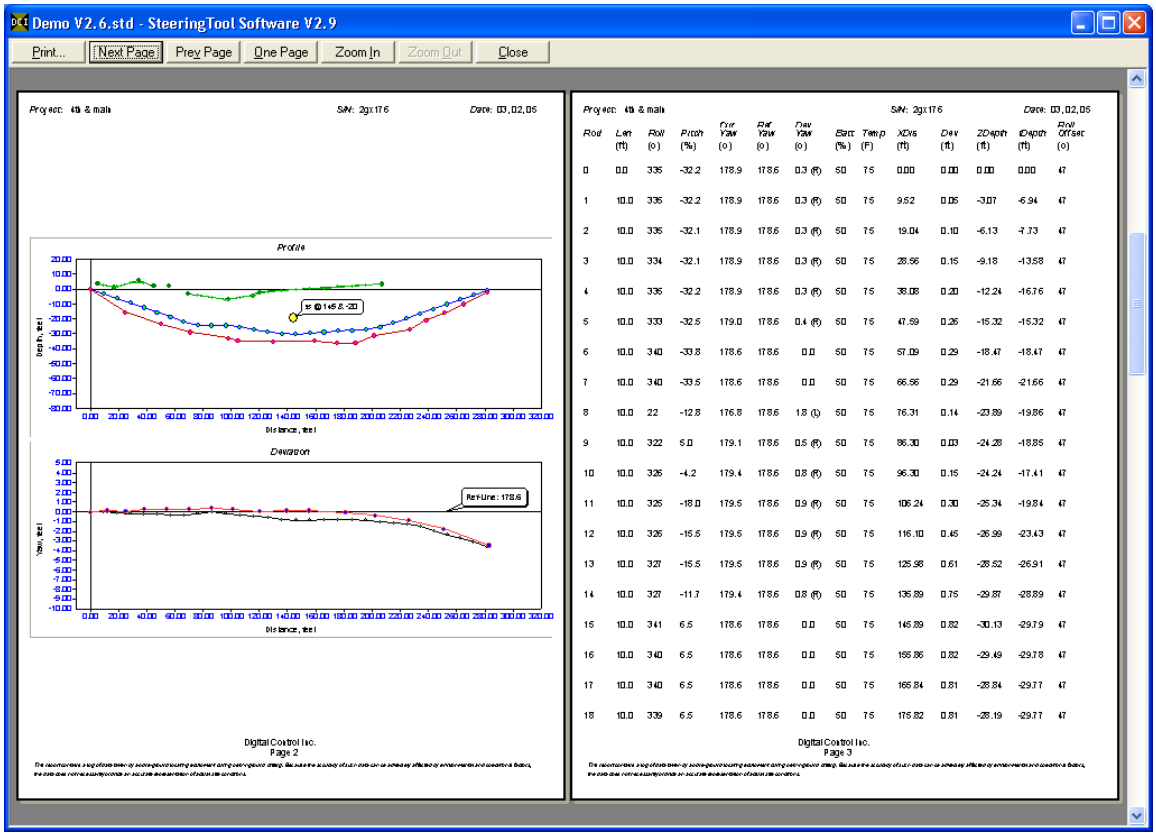
Open Dialog Box

2. Select the desired project file (in this example, Demo V2.6.std), or navigate to the folder where you have stored your project files and select the desired file. Then click on **Open**. You will see the data appear in the application window.

NOTE:	Recorded bore data can only be opened with the exact same version of software as when it was recorded. If the SST computer software is upgraded, do not overwrite or erase older versions of the software, since you will need them to open old bore files. It may be a good idea to save the bore file using the version number in the file name (e.g., Bore1v26.std, Bore1Rev1v26.std, etc.)

Printing and Previewing Project Files

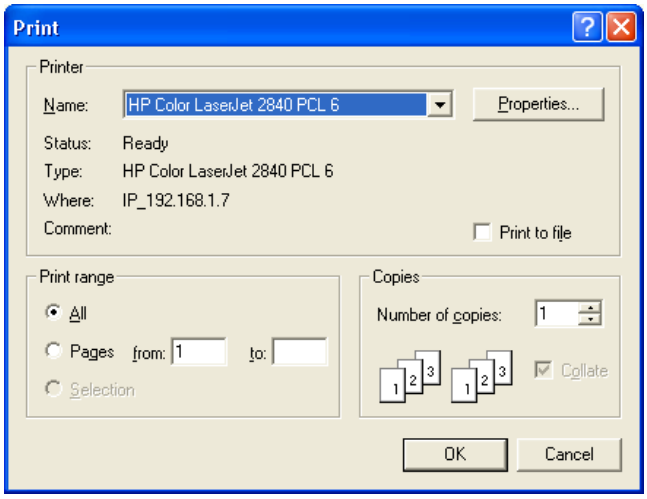
1. If you want to preview the printed pages before you send the file to print, select **Print Preview** from the **File** menu. The example shown below is in portrait orientation. For a long bore, you can change your print setup to landscape orientation (under **File | Print Setup …**) so that the bore details are not as compressed.



Print Preview of Drill Data (Pages 2 and 3)

2. The entire bore's data will print on at least three pages. The drill information (which includes the job site and customer and contractor data) will appear on the first page, the Profile and Deviation plots will be on the second page, and the drill data listed in the Logged Data field will print on the third page (and more if needed).

3. To print the project data, select **Print** from the **File** menu. You will see the Print dialog box.

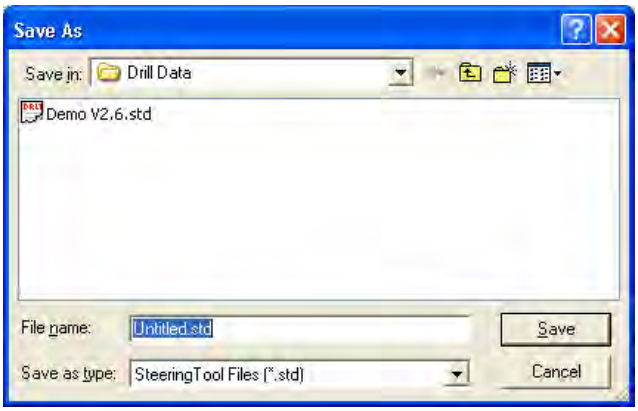


Print Dialog Box

4. Make any adjustments needed in the Print dialog box, then click **OK**. If you have the Adobe Acrobat PDF writer software, you can select the Adobe PDF printer to print to a PDF file (see your software documentation). This allows you to save the file as a PDF, which can be e-mailed to and viewed by anyone with Adobe Acrobat reader (available at no charge on the Internet).

Saving Project Files

1. To save an open project file, select **Save** from the **File** menu. The file will automatically be saved under its current file name (shown on the left in the title bar) and location. If the project has not yet been saved and named, then the file will automatically save to the default file name Untitled.std in the default location for storing project files (C:\Program Files\Digital Control Incorporated\Steering Tool\Drill Data).
2. To save a file with a different file name or location, select **Save As** from the **File** menu. You will see the Save As dialog box, which automatically opens to the folder where the current file is stored.



Save As Dialog Box

3. Change the file name and location as desired, then click **Save**. The open file will now have the new file name and/or location.

NOTE:	Recorded bore data can only be opened with the exact same version of software as when it was recorded. If the SST software is upgraded, do not overwrite or erase older versions of the software, since you will need them to open old bore files. It may be a good idea to save the bore file using the version number in the file name (e.g., Bore1v26.std, Bore1Rev1v26.std, etc.)

When you save a project file, the file name will end with “std” (e.g., Projectname.std). The Eclipse SST program also generates four accompanying files: two “chd” files (Projectname PlanView.chd and Projectname Profile.chd) and two “txt” files (Projectname PlanView.txt and Projectname Profile.txt).

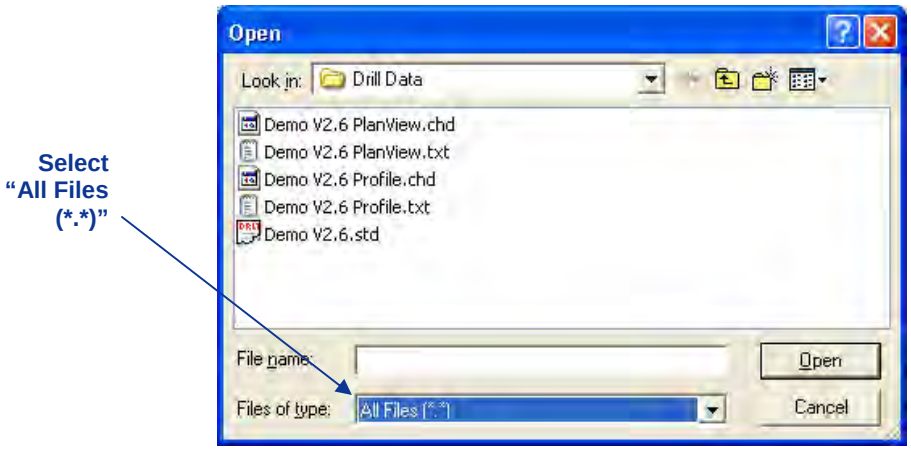
E-mailing Project Files

You can send Eclipse SST project files via e-mail. E-mailed files can be opened on any computer that has the same version of the Eclipse SST software as used on the originating computer.

The Eclipse SST program generates five files for each run: the standard SST file (*.std) and four other files related to the plots. For example, for the project file named “Projectname.std”, there will be two *.chd files (“Projectname PlanView.chd” and “Projectname Profile.chd”) and two *.txt (“Projectname PlanView.txt” and “Projectname Profile.txt”).

NOTE:	All five project files (the *.std, *.chd, and *.txt files) must be e-mailed and saved to the same folder on the receiving computer so that the data will display correctly.

To e-mail files for a project, select the five project files as attachments in your e-mailing application, and then send the e-mail. The default location of the Eclipse SST program data is C:\Program Files\Digital Control Incorporated\Steering Tool\Drill Data. You can see the different file types under the Drill Data folder by setting the drop-down selection at the bottom of the open dialog box to “All Files (*.*)”, as shown below. Note that the five files that comprise the data for the SST project named “Demo V2.6” are listed in this dialog box.



Open Dialog Box Showing All Files (*.*)

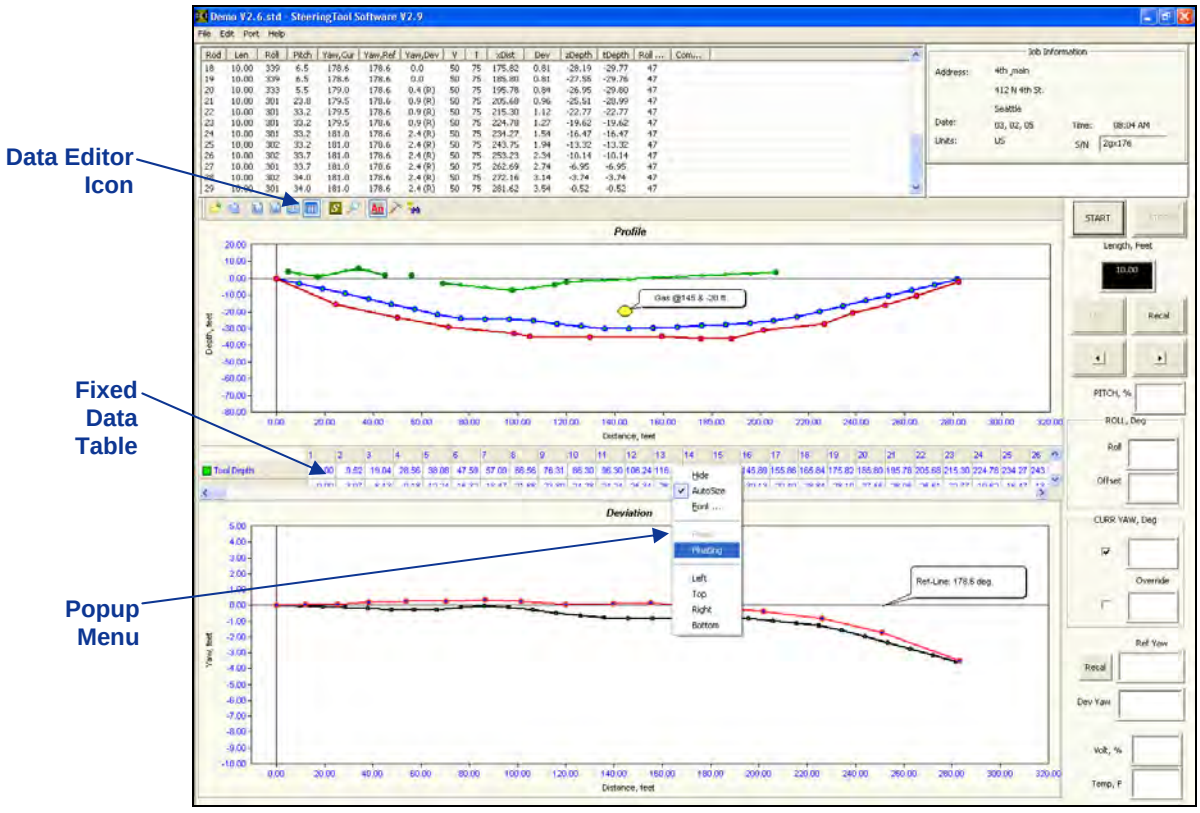
NOTE:	If you have made a PDF file of the project data, then you can select the PDF file for e-mailing.

Inputting and Changing Drill Data

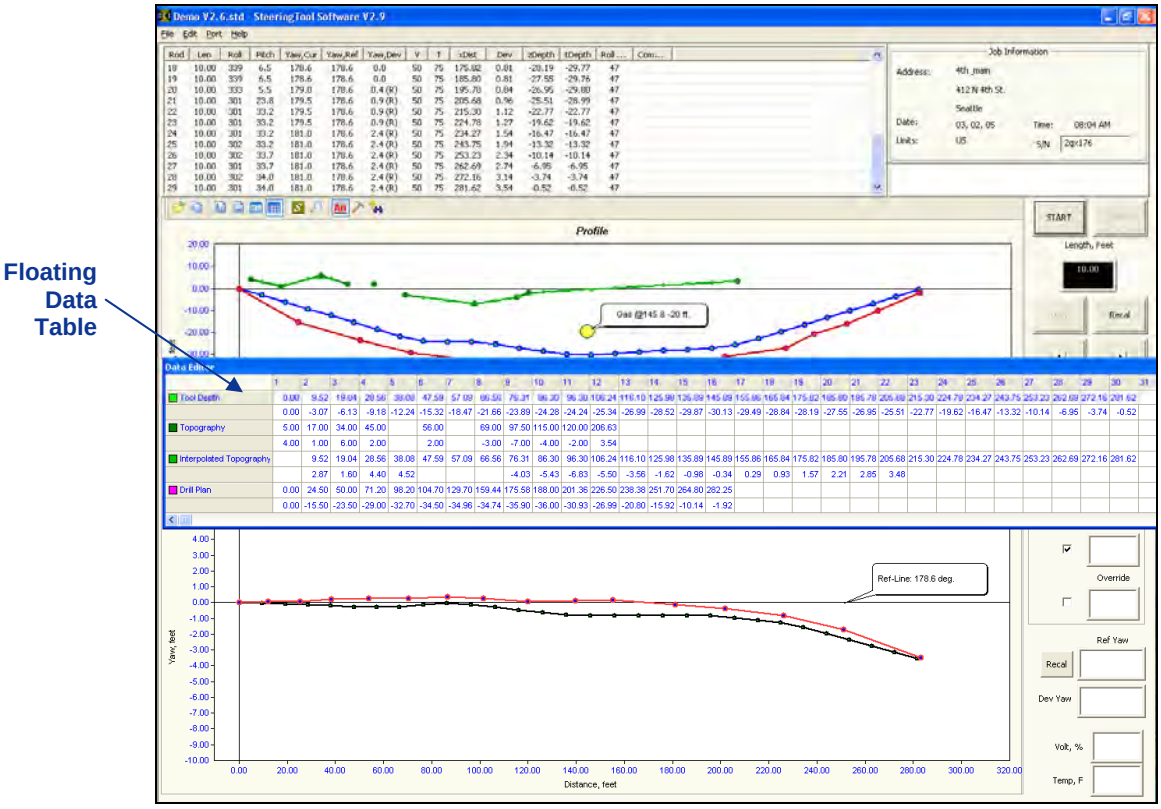
You can manually edit SST project files by plotting topography (topo), planned bore (drill plan), and planned deviation (tool deviation) into the SST software either before, during, or after a bore. You can also import this information from an Excel file, but it must be done prior to logging a SST bore. The instructions for importing information from an Excel file are provided in the Appendix.

The Data Editor is used to enter topo, drill plan, or planned deviation data manually in either the Profile or Deviation plot. To open the Data Editor, click on the icon in the toolbar or, if the toolbar is not displayed, right click in the plot area and then select the Data Editor from the popup menu.

Clicking on the Data Editor icon will open the Data Editor table at the bottom of the plot area. The table will be partially hidden and will have scroll bars to allow viewing of the hidden data. To move the Data Editor table for easier viewing and editing, place the cursor in the table area and right click, then select the Floating option from the popup menu. The data table will then be in a box that you can move around the plot area; place your cursor on the top blue title bar, then click and hold the left mouse button while dragging the box to a new location. The following graphics show the data table as it appears when you first open it and as it appears after you have selected the Floating option.



Locating Toolbars and Data Tables



Floating Data Table

To close the table, whether it is floating or fixed, place the cursor in the table area and right click, then select the Hide option from the popup menu. You can also close the table by clicking on the Data Editor icon.

Entering Topography and/or Drill Plan

Data Editor Table for Profile Plot

Data Editor

	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	
Tool Depth	0.00	9.52	19.04	28.56	38.08	47.59	57.09	66.56	76.31	86.30	96.30	106.24	116.10	125.98	135.89	145.89	155.86	165.84	175.82	Computer Generated
	0.00	-3.07	-6.13	-9.18	-12.24	-15.32	-18.47	-21.66	-23.89	-24.28	-24.24	-25.34	-26.99	-28.52	-29.87	-30.13	-29.49	-28.84	-28.19	
Topography	5.00	17.00	34.00	45.00		56.00		69.00	97.50	115.00	120.00	206.63								Manually Entered
	4.00	1.00	6.00	2.00		2.00		-3.00	-7.00	-4.00	-2.00	3.54								
Interpolated Topography		9.52	19.04	28.56	38.08	47.59	57.09	66.56	76.31	86.30	96.30	106.24	116.10	125.98	135.89	145.89	155.86	165.84	175.82	Computer Generated
		2.87	1.60	4.40	4.52				-4.03	-5.43	-6.83	-5.50	-3.56	-1.62	-0.98	-0.34	0.29	0.93	1.57	
Drill Plan	0.00	24.50	50.00	71.20	98.20	104.70	129.70	159.44	175.58	188.00	201.36	226.50	238.38	251.70	264.80	282.25				Manually Entered
	0.00	-15.50	-23.50	-29.00	-32.70	-34.50	-34.96	-34.74	-35.90	-36.00	-30.93	-26.99	-20.80	-15.92	-10.14	-1.92				

The Data Editor table for the Profile plot has numbered columns across the top of the table that correspond to the locations where data will be or has been logged. Column 1 contains data for the first logged point; column 2 contains data for the second logged point, etc.

The Profile plot table lists the four plotted profiles—Tool Depth, Topography, Interpolated Topography, and Drill Plan. The upper row for each of these plots gives the x-coordinate or horizontal distance from the launch point. The lower row gives the y-coordinate, or the distance above or below the zero elevation line or x-axis.

- **Tool Depth** – These x,y coordinates are computer generated automatically by the SST system's software when you log the bore—you will not enter any information in these two rows.
- **Topography** – These x,y coordinates are based off of the zero elevation (launch point) and are manually entered either prior to, during, or after the bore. If the topography is below the zero elevation line, you must enter a minus ("–") sign; however, if the topo is above the zero elevation line you do not have to enter a plus ("+") sign.
- **Interpolated Topography** – These x,y coordinates are computer generated automatically by the SST system's software when you log the bore—you will not enter any information in these two rows.
- **Drill Plan** – These x,y coordinates are used for plotting a planned bore and are manually entered either prior to, during, or after the bore. If the drill plan is entered after the topography has been entered, the y-value will be based off of the topo. If no topo is entered, the y-value will be measured from the zero elevation line.

If you are using English units of measure for depth, the number must be in decimal format for feet; e.g., if you want to use the value 4 ft 8 in., you will enter 4.67. If you are using metric units of measure for depth, then the number must be in decimal format for meters. The values for the x,y coordinates for the Topography and Drill Plan will be based off of the zero elevation line, which is established at the first logged point. If the Topography and/or Drill Plan is below the zero elevation line, then you must enter a "–" sign. If the Topography and/or Drill Plan is above the zero elevation line, you do not have to enter a "+" sign.

Entering or Changing Topography and Drill Plan Data in Profile Table

The first column for the Tool Depth plot will always show as x = 0.00 and y = 0.00, because the first point recorded on an SST bore is when the tool is ½ in the ground and ½ out of the ground—referred to as the zero, zero point. When manually entering the Drill Pan, you must enter for the coordinates in the first column 0.00, 0.00. The first column for the topography data does not require this.

You do not need to enter x,y coordinates for every logged location. For instance if you only have five topo points to plot, you will only have five columns of data with the first column corresponding to the shortest x-distance and the last column having the largest x-distance.

To enter or change values for the x,y coordinates in the Topography or Drill Plan data, double-click on a value and then type in the new value and hit enter.

Notice that when you display the toolbars and the Data Editor, the plots may appear compressed or distorted. The plots should return to normal after the toolbars and Data Editor are closed.

Entering Tool's Planned Deviation

Data Editor Table for Deviation Plot

The Data Editor table for the Deviation plot has numbered columns across the top of the table that correspond to the locations where data will be or has been logged, as in the table for the Profile plot. Column 1 contains data for the first logged point; column 2 contains data for the second logged point, etc. Note that the first column will always have 0.00 in each cell, because the first point recorded on an SST bore is when the tool is ½ in the ground and ½ out of the ground—referred to as the zero, zero point.

The deviation table has only two plotted profiles—Tool Deviation and an unnamed blank field, which you should name appropriately (see below). There are two rows of values for each of these plotted profiles—the upper row gives the x-coordinate or horizontal distance from the launch point, and the lower row gives the y-coordinate or the distance above or below the zero elevation line or x-axis.

- **Tool Deviation** – These x,y coordinates are computer generated automatically by the SST system's software when you log the bore—you will not enter any information in these two rows.
- **Unnamed or Blank** – The x,y coordinates for this field are based on the launch point position and are manually entered prior to, during, or after the bore. If the planned deviation is to the right of the launch point (below the x-axis), you must enter a "–" sign, if the planned deviation is to the left of the launch point (above the x-axis), you do not have to enter a "+" sign.

Naming Blank Field for Deviation Plot

The unnamed plotted profile field is left blank so that you can name it appropriately for your job. DCI suggests something like Planned Deviation or Planned Line. To name this blank field, place the cursor in the cell and double-click, then type the desired name and hit enter.

Entering or Changing Data for Planned Deviation Plot

To enter or change values for the x,y coordinates in the deviation table, double-click on a value and then type in the new value and hit enter.

Graphing Options

You can change the appearance of the Profile and Deviation plots in a variety of ways. The various options that are available are discussed below. Some options will alter the appearance of both plots, and some will only alter the plot in which you are working. Place your cursor in the plot area that you want to change to open the Chart FX dialog box that affects that plot area.

Changing Appearance and Location of X and Y Axes

To change the appearance and location of the x- or y-axis in either the Profile or Deviation plot, place the cursor in the desired plot area, and right click; then select Properties... from the popup menu to open the Chart FX Properties dialog box. Select the Axes tab, as shown below.

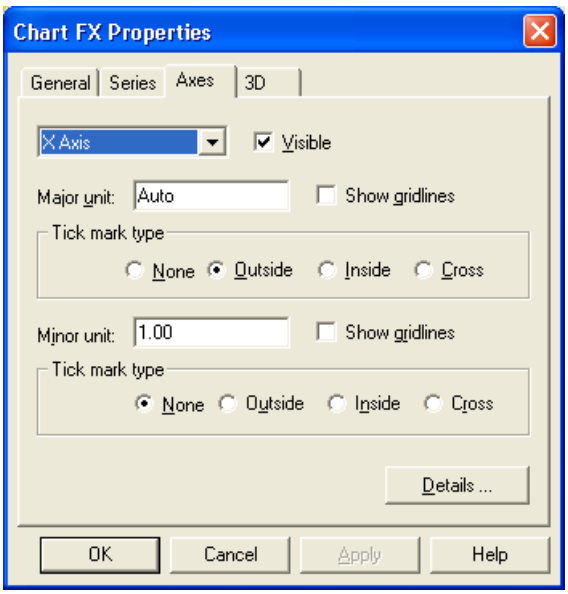
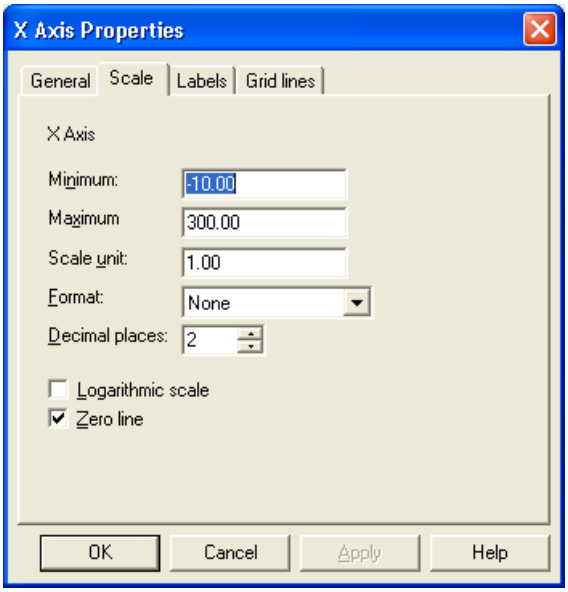


Chart FX Properties Dialog Box – Axes Tab

Click on the top left field's drop-down arrow and select the X or Y axis, then click the Details button at the bottom of the dialog box to open the X or Y Axis Properties dialog box.



X Axis Properties Dialog Box – Scale Tab

The Scale tab is automatically selected. Make the desired changes in the Minimum and Maximum boxes, and click Apply. You will see the plots adjust accordingly. Click on OK or on the "X" in the upper right corner of the Chart FX Properties dialog box to close it.

NOTE:	The X Axis properties affect both the Profile and Deviation plots. The Y Axis Properties affect only one plot. If you open the Chart FX properties from the Profile plot, changes made in the Y Axis Properties box will only affect the Profile plot.

You may want to change the appearance of the plots to eliminate excess white space. Simple instructions are given below for common changes you may want to make.

Change Vertical Scale (Move X-Axis Up or Down in Profile Plot)

1. Right mouse click in Profile plot area.
2. Select Properties... from popup menu.
3. Click on Axes tab in Chart FX Properties dialog box.
4. Select Y Axis in upper left field.
5. Click on Details button to open Y Axis Properties dialog box.
6. Under Scale tab (which is automatically selected), in the Minimum box, type in a negative value; this defines the placement of the x-axis and, therefore, the amount of white space displayed above and below the x-axis.
7. Type in a value for the Maximum; this represents the amount of white space displayed above the x-axis.
8. Click on Apply to see the plot shift according to the values you have input.
9. Click on OK to exit dialog box, then on OK again to exit Chart FX dialog box.

Change Horizontal Scale (Move Y-Axis to Left or Right in Profile Plot)

1. Right mouse click in Profile plot area.
2. Select Properties... from popup menu.
3. Click on Axes tab in Chart FX Properties dialog box.
4. Click on drop-down arrow in upper left field and select X Axis.
5. Click on Details button to open X Axis Properties dialog box.
6. Under Scale tab (which is automatically selected), in the Minimum box, type in a value, usually negative, to move the y-axis to the left or right. A zero value will place the y-axis at the left edge of the graph; a positive value will place the y-axis outside the graph area to the left.
7. Type in a value for the Maximum, which specifies the horizontal distance displayed. The ideal number will be just a little greater than the borepath's maximum x-distance, as displayed in the xDist column in the Logged Data field.
8. Click on Apply to see the plot shift according to the values you have input.
9. Click on OK to exit dialog box, then on OK again to exit Chart FX dialog box.

Move Axes in Deviation Plot

1. Right mouse click in the Deviation plot area.
2. You will get the same series of dialog boxes as described above for the Profile plot area. Follow the instructions given above to change the appearance of the Deviation plot.

Changing Appearance of Plotted Profiles

To change the color scheme used in the plotted profiles, open the Chart FX Properties dialog box in the plot area you want to change, and click on the Series tab.

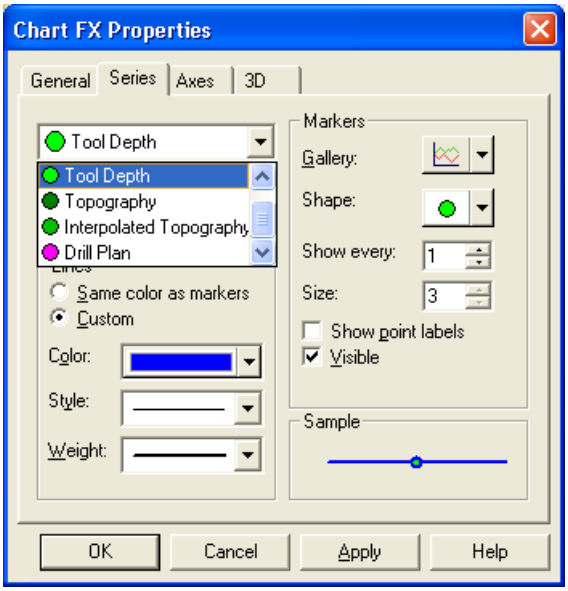


Chart FX Properties Dialog Box – Series Tab

In the graphic above, the Series tab is selected and the drop-down list for the top left field is clicked to display the four plots. Once one plot is selected, as shown below, the color, size, and shape of the line and data points for that plot can be changed. After making changes, click the Apply button to see the desired changes take effect.

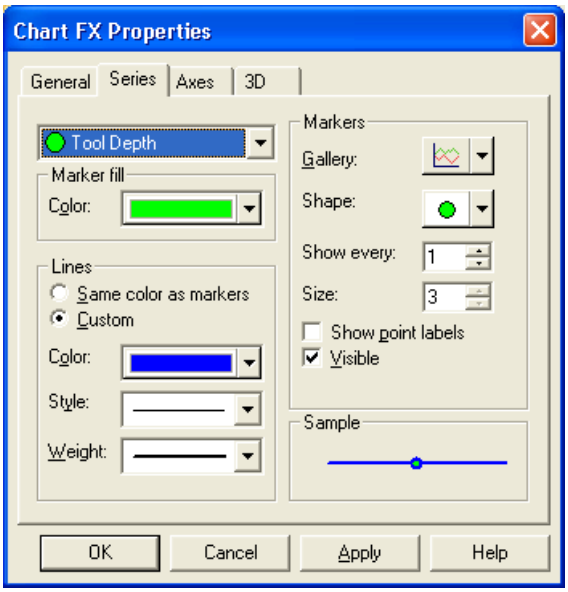


Chart FX Properties Dialog Box – Selecting Plot to Edit

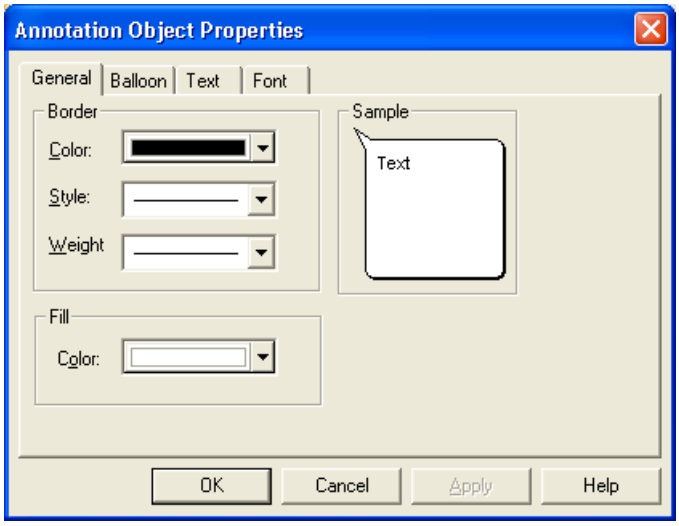
Drawing and Changing Objects on Plots

The annotate toolbar provides tools for drawing objects, importing artwork, or adding text to either the Profile or Deviation plot. The annotate toolbar must be displayed to enable you to select an icon or function. See "Plot Area Toolbars" in the *Computer Instructions* section for information on how to display the annotate toolbar and descriptions of the icons or functions provided on the toolbar.

Annotate Toolbar:

Using the pointer , you can select an existing object. Moving the pointer or cursor over an object changes it to a four-arrow cursor and allows you to select the object. Once selected, an object will have a shaded line and handles (or little black squares) around it, and you will be able to drag the object around or enlarge or reduce it.

When you have an object selected with the four-arrow cursor, you can click the right mouse button to display a popup menu with more drawing options, including access to the Annotation Object Properties dialog box. You can also access this dialog box, which allows more ways to edit the object, by double-clicking the four-arrow cursor or by right clicking with the four-arrow cursor and then selecting Properties... from the popup menu.



Annotation Object Properties Dialog Box

The next four icons after the cursor allow you to draw rectangles, circles or ovals, lines with or without arrowheads, and curved (arc) lines. These tools work in a similar manner to those provided in drawing programs. To use them, click on the icon and then place the cursor where you want to draw the item; click and hold in the mouse button as you drag the cursor to make the object the desired size.

Next is the picture import icon, which allows you to import a graphic from another application. The picture import function is not activated (does not function) in the current version of Steering Tool software.

Then the toolbar provides two text box tools. The first allows you to draw a plain text box. The second allows you to draw a balloon with text in it. To draw either type of text box, select the desired icon, and then place the cursor where you want the box and drag the cursor to make the object the desired size in the desired location. Then double-click on the word “Text” that appears in the box and type in the desired text.

The remainder of the tools on the annotate toolbar are standard drawing tools. Their functions are explained under the description of the annotate toolbar under “Plot Area Toolbars” earlier in this section.

Notes

APPENDIX
Importing Topography, Drill Plan, and Planned Deviation from Excel File

The SST software allows you to import topography, drill plan, and planned deviation data from a text file created in Microsoft Excel. This should be done before you start logging your SST bore.

Create Text File

The file must be in the correct format for importing, as shown in the following figure. Each plot or set of data (topography, drill plan, and planned deviation) spans two columns that list the x-coordinate in the first column and the y-coordinate in the second column for each logged point.

Microsoft Excel - Entering and Importing topo drill plan tool dev.xls

File Edit View Insert Format Tools Data Window Help Adobe PDF

S41

	A	B	C	D	E	F	G	H
1	TOPOGRAPHY		DRILL PLAN		PLANNED DEVIATION			
2	x	y	x	y	x	y		
3	0	0	0	0	0	0		
4	3	0	3	-0.25	3	-0.2		
5	6	1	6	-0.5	6	-0.4		
6	9	1.5	9	-0.75	9	-0.6		
7	12	2	12	-1	12	-0.8		
8	15	2	15	-1.25	15	-1		
9	18	2	18	-1.5	18	-1.2		
10	21	1.5	21	-1.75	21	-1.4		
11	24	1.5	24	-2	24	-1.6		
12	27	1	27	2.25	27	-1.8		
13	30	1	30	-2.5	30	-2		
14	33	0.5	33	-2.75	33	-2.2		
15	36	0.5	36	-3	36	-2.4		
16	39	0	39	-3.25	39	-2.6		
17	42	0	42	-3.25	42	-2.8		
18	45	0	45	-3.25	45	-3		
19	48	0	48	-3.25	48	-3.2		
20	51	-1	51	-3.25	51	-3.4		
21	54	-0.5	54	-3.25	54	-3.6		
22	57	-0.25	57	-3.25	57	-3.8		
23	60	0	60	-3.25	60	-4		
24	63	0.25	63	-3.25	63	-4.2		
25	66	0.5	66	-3.25	66	-4.4		

First row of data

Format for Data in Excel File

The first row of data will always consist of zeroes. This is because the first logged point is recorded when the SST transmitter (in the housing) is positioned so that it is ½ in and ½ out of the ground. This point is measured as zero, or 0.0, for both the x- and y-coordinates.

Note that the x,y coordinate values must be in decimal format (not using fractions). For example, if you want to enter 4 ft 8 in., then you will enter the value 4.67.

For each data plot, the x-coordinate value will give the distance from the start of the bore. The x-value will be positive and will continue to increase from the start of the bore.

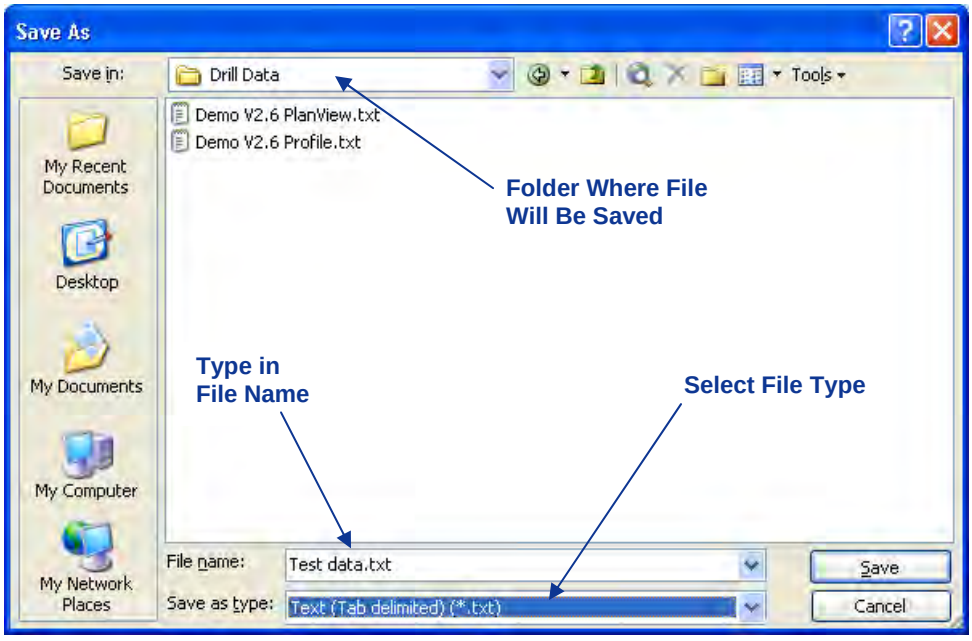
The y-coordinate value for the topography and drill plan plots will give the distance from the zero elevation line or the x-axis. If the value is negative or below the zero elevation line, you must enter a "–" sign in front of the value. You do not need to enter a "+" sign for a positive value.

The y-coordinate value for the planned deviation will also require a "–" sign in front of the value when the Deviation plot is negative and goes below the x-axis.

Save Text File

Once you have input the information in the Excel spreadsheet, you need to save the file in the correct format. The SST software requires a tab-delimited text file (*.txt) for import. Follow the steps given below to save the data as a text file.

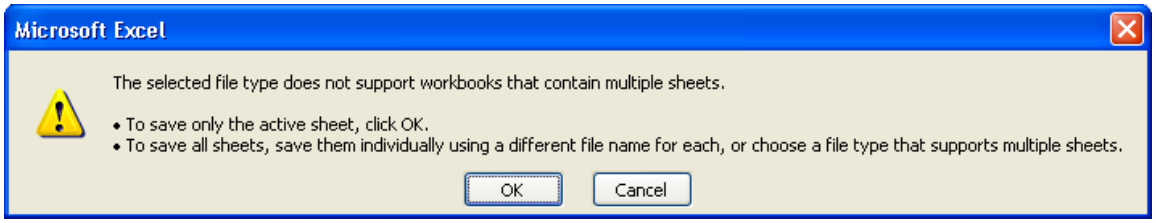
1. To save the file, select **File | Save As** on the menu bar to open the Save As dialog box.



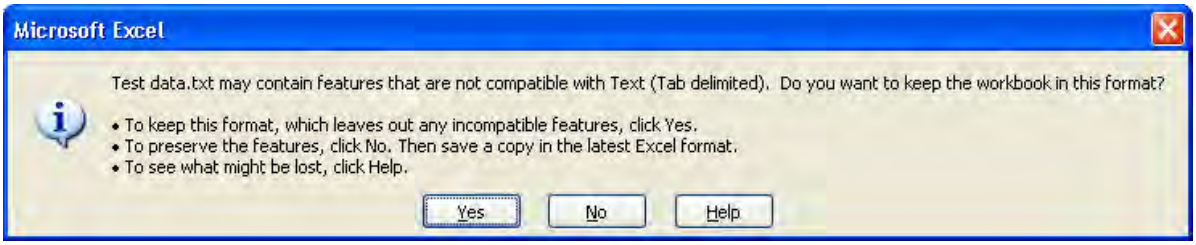
Save As Dialog Box in Excel Application

2. In this dialog box, change the folder where you want to save the file at the top of the dialog box, if necessary.

3. Type in the desired file name where indicated at the bottom of the dialog box.
4. Then select the “Text (Tab delimited) (*.txt)” option in the “Save as type” drop-down box at the bottom of the dialog box.
5. Click on Save. You will see the following dialog box:


Microsoft Excel
The selected file type does not support workbooks that contain multiple sheets.
• To save only the active sheet, click OK.
• To save all sheets, save them individually using a different file name for each, or choose a file type that supports multiple sheets.
OK
Cancel

6. Click OK. You will then see another dialog box appear as follows:

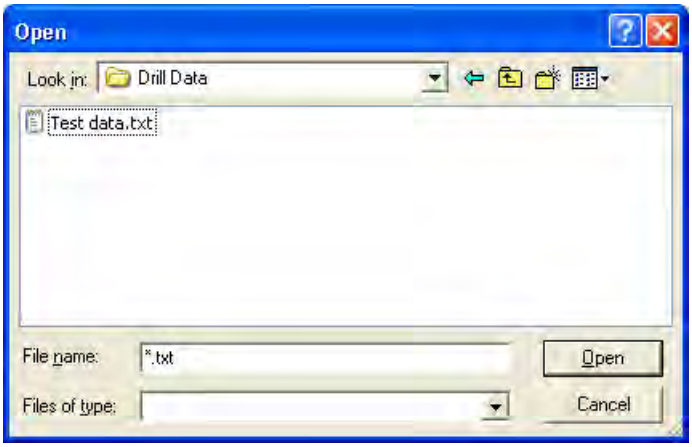

Microsoft Excel
Test data.txt may contain features that are not compatible with Text (Tab delimited). Do you want to keep the workbook in this format?
• To keep this format, which leaves out any incompatible features, click Yes.
• To preserve the features, click No. Then save a copy in the latest Excel format.
• To see what might be lost, click Help.
Yes
No
Help

7. Click on Yes. The file has now been saved. In this example the file name is Test data.txt.

You can now exit the Excel application. You will see the same series of dialog boxes again; answer the same as above and the application will then close.

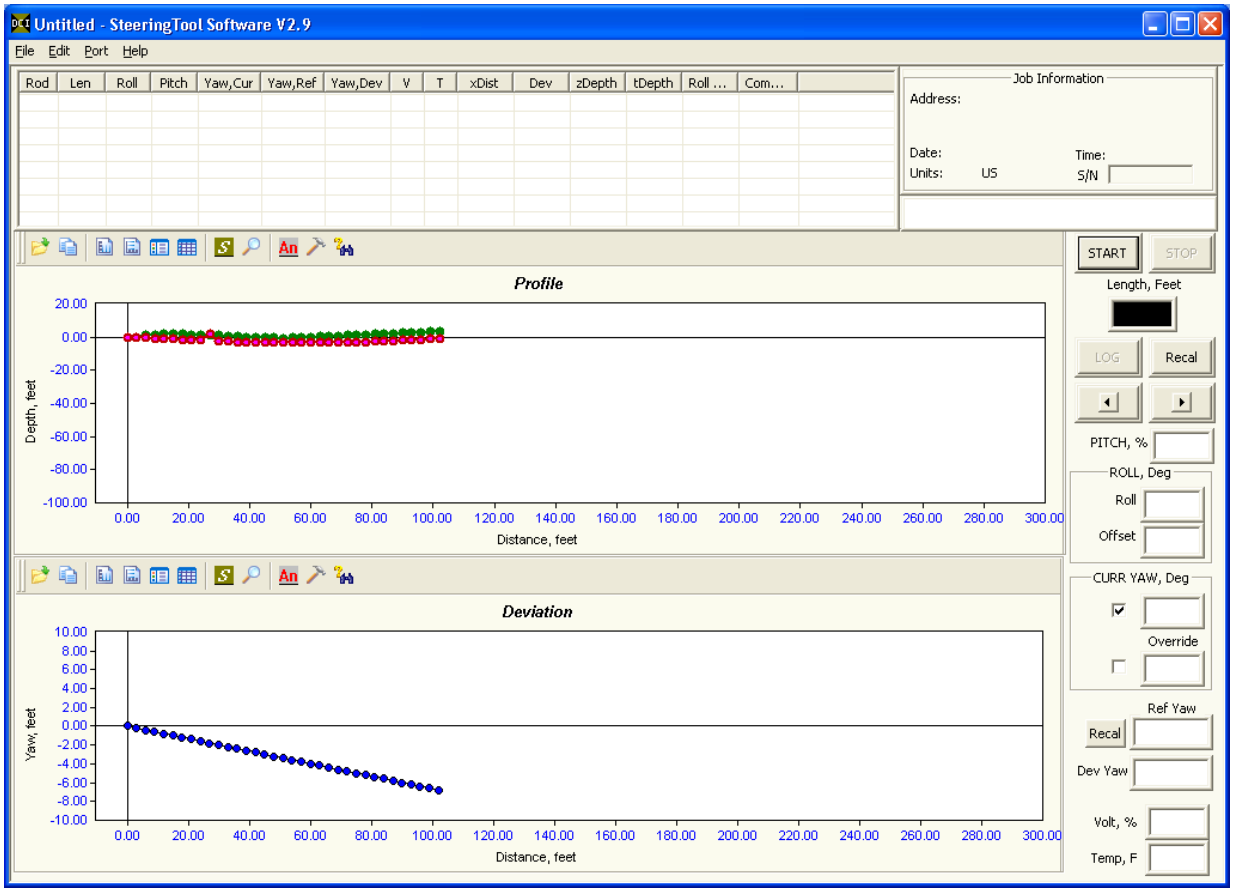
Import Text File into SST Software

1. Open the SST software.
2. Click on the Import Topography icon in the standard toolbar to open the Open dialog box.



Open Dialog Box

3. Select the file, after navigating to the folder where you saved it if necessary.
4. Click the Open button. You should see the three plotted profiles in the plot area of the SST application.

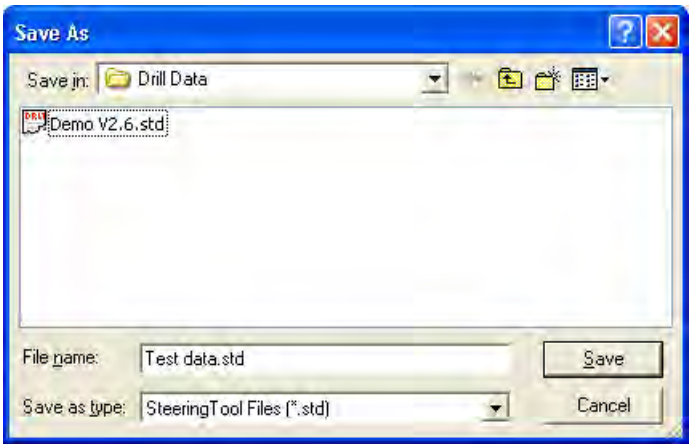


Import of Text File

5. You may need to adjust the scaling. For example, the plots in the graphic above are compressed to the left of the plot area. See “Graphing Options” in the *Inputting and Changing Drill Data* section of the manual for information on how to edit the plots. For example, the graphic below shows how the plots look after adjusting the Y Axis properties.

Appearance of Plots After Making Graphic Changes

6. You should save the data after it is in the desired format. To save, select the **File | Save** menu command to open the Save As dialog box.



Save As Dialog Box in SST Application

You have now saved the data as a Steering Tool file.

Notes

3-1200-00-D1

DIGITAL CONTROL INCORPORATED

19625 62nd Ave. S., Suite B-103 • Kent, WA 98032 USA • (425) 251-0559 OR (800) 288-3610 • FAX (253) 395-2800
www.digitrak.com (Web Site) dci@digital-control.com (E-mail)

LIMITED WARRANTY

Digital Control Incorporated ("DCI") warrants that when shipped from DCI each DCI product ("DCI Product") will conform to DCI's current published specifications in existence at the time of shipment and will be free, for the warranty period ("Warranty Period") described below, from defects in materials and workmanship. The limited warranty described herein ("Limited Warranty") is not transferable, shall extend only to the first end-user ("User") purchasing the DCI Product from either DCI or a dealer expressly authorized by DCI to sell DCI Products ("Authorized DCI Dealer"), and is subject to the following terms, conditions and limitations:

1. A Warranty Period of twelve (12) months shall apply to the following new DCI Products: receivers/locators, remote displays, battery chargers and rechargeable batteries, and DataLog® modules and interfaces. A Warranty Period of ninety (90) days shall apply to all other new DCI Products, including transmitters, accessories, and software programs and modules. Unless otherwise stated by DCI, a Warranty Period of ninety (90) days shall apply to: (a) a used DCI Product sold either by DCI or by an Authorized DCI Dealer who has been expressly authorized by DCI to sell such used DCI Product; and (b) services provided by DCI, including testing, servicing, and repairing an out-of-warranty DCI Product. The Warranty Period shall begin from the later of: (i) the date of shipment of the DCI Product from DCI, or (ii) the date of shipment (or other delivery) of the DCI Product from an Authorized DCI Dealer to User.

2. DCI's sole obligation under this Limited Warranty shall be limited to either repairing, replacing, or adjusting, at DCI's option, a covered DCI Product that has been determined by DCI, after reasonable inspection, to be defective during the foregoing Warranty Period. All warranty inspections, repairs and adjustments must be performed either by DCI or by a warranty claim service authorized in writing by DCI. All warranty claims must include proof of purchase, including proof of purchase date, identifying the DCI Product by serial number.

3. The Limited Warranty shall only be effective if: (i) within fourteen (14) days of receipt of the DCI Product, User mails a fully-completed Product Registration Card to DCI; (ii) User makes a reasonable inspection upon first receipt of the DCI Product and immediately notifies DCI of any apparent defect; and (iii) User complies with all of the Warranty Claim Procedures described below.

WHAT IS NOT COVERED

This Limited Warranty excludes all damage, including damage to any DCI Product, due to: failure to follow DCI's user's manual and other DCI instructions; abuse; misuse; neglect; accident; fire; flood; Acts of God; improper applications; connection to incorrect line voltages and improper power sources; use of incorrect fuses; overheating; contact with high voltages or injurious substances; or other events beyond the control of DCI. This Limited Warranty does not apply to any equipment not manufactured or supplied by DCI nor, if applicable, to any damage or loss resulting from use of any DCI Product outside the designated country of use. By accepting a DCI Product and not returning it for a refund within thirty (30) days of purchase, User agrees to the terms of this Limited Warranty, including without limitation the Limitation of Remedies and Liability described below, and agrees to carefully evaluate the suitability of the DCI Product for User's intended use and to thoroughly read and strictly follow all instructions supplied by DCI (including any updated DCI Product information which may be obtained at the above DCI website). In no event shall this Limited Warranty cover any damage arising during shipment of the DCI Product to or from DCI.

User agrees that the following will render the above Limited Warranty void: (i) alteration, removal or tampering with any serial number, identification, instructional, or sealing labels on the DCI Product, or (ii) any unauthorized disassembly, repair or modification of the DCI Product. In no event shall DCI be responsible for the cost of or any damage resulting from any changes, modifications, or repairs to the DCI Product not expressly authorized in writing by DCI, and DCI shall not be responsible for the loss of or damage to the DCI Product or any other equipment while in the possession of any service agency not authorized by DCI.

DCI reserves the right to make changes in design and improvements upon DCI Products from time to time, and User understands that DCI shall have no obligation to upgrade any previously manufactured DCI Product to include any such changes.

The foregoing Limited Warranty is DCI's sole warranty and is made in place of all other warranties, express or implied, including but not limited to the implied warranties of merchantability and fitness for a particular purpose and any implied warranty arising from course of performance, course of dealing, or usage of trade. If DCI has substantially complied with the warranty claim procedures described below, such procedures shall constitute User's sole and exclusive remedy for breach of the Limited Warranty.

LIMITATION OF REMEDIES AND LIABILITY

In no event shall DCI nor anyone else involved in the creation, production, or delivery of the DCI Product be liable for any damages arising out of the use or inability to use the DCI Product, including but not limited to indirect, special, incidental, or consequential damages or for any cover, loss of information, profit, revenue or use based upon any claim by User for breach of warranty, breach of contract, negligence, strict liability, or any other legal theory, even if DCI has been advised of the possibility of such damages. In no event shall DCI's liability exceed the amount User has paid for the DCI Product. To the extent that any applicable law does not allow the exclusion or limitation of incidental, consequential or similar damages, the foregoing limitations regarding such damages shall not apply.

This Limited Warranty gives you specific legal rights, and you may also have other rights which vary from state to state. This Limited Warranty shall be governed by the laws of the State of Washington.

WARRANTY CLAIM PROCEDURES

1. If you are having problems with your DCI Product, you must first contact the Authorized DCI Dealer where it was purchased. If you are unable to resolve the problem through your Authorized DCI Dealer, contact DCI's Customer Service Department in Kent, Washington, USA at the above telephone number between 6:00 a.m. and 6:00 p.m. Pacific Time and ask to speak with a customer service representative. (The above "800" number is available for use only in the USA and Canada.) Prior to returning any DCI Product to DCI for service, you must obtain a Return Merchandise Authorization (RMA) number. Failure to obtain a RMA may result in delays or return to you of the DCI Product without repair.

2. After contacting a DCI customer service representative by telephone, the representative will attempt to assist you in troubleshooting while you are using the DCI Product during actual field operations. Please have all related equipment available together with a list of all DCI Product serial numbers. It is important that field troubleshooting be conducted because many problems do not result from a defective DCI Product, but instead are due to either operational errors or adverse conditions occurring in the User's drilling environment.

3. If a DCI Product problem is confirmed as a result of field troubleshooting discussions with a DCI customer service representative, the representative will issue a RMA number authorizing the return of the DCI Product and will provide shipping directions. You will be responsible for all shipping costs, including any insurance. If, after receiving the DCI Product and performing diagnostic testing, DCI determines the problem is covered by the Limited Warranty, required repairs and/or adjustments will be made, and a properly functioning DCI Product will be promptly shipped to you. If the problem is not covered by the Limited Warranty, you will be informed of the reason and be provided an estimate of repair costs. If you authorize DCI to service or repair the DCI Product, the work will be promptly performed and the DCI Product will be shipped to you. You will be billed for any costs for testing, repairs and adjustments not covered by the Limited Warranty and for shipping costs. In most cases, repairs are accomplished within 1 to 2 weeks.

4. DCI has a limited supply of loaner equipment available. If loaner equipment is required by you and is available, DCI will attempt to ship loaner equipment to you by overnight delivery for your use while your equipment is being serviced by DCI. DCI will make reasonable efforts to minimize your downtime on warranty claims, limited by circumstances not within DCI's control. If DCI provides you loaner equipment, your equipment must be received by DCI no later than the second business day after your receipt of loaner equipment. You must return the loaner equipment by overnight delivery for receipt by DCI no later than the second business day after your receipt of the repaired DCI Product. Any failure to meet these deadlines will result in a rental charge for use of the loaner equipment for each extra day the return of the loaner equipment to DCI is delayed.